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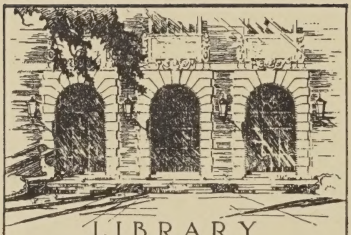

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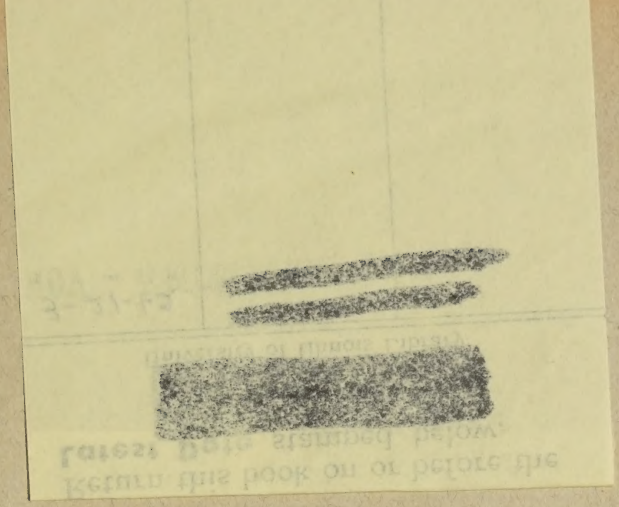

Chas. H. West

Grenville, Miss.

REPORT

OF

PROCEEDINGS OF THE CONGRESS

H. M. KING GEORGE V

Patron

XIIIth International Navigation Congress

London, 1923.

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PERMANENT INTERNATIONAL ASSOCIATION

OF

NAVIGATION CONGRESSES

REPORT

OF

Proceedings of the XIIIth Congress

LONDON 1923

Executive Committee. — Office of the General Secretary
38, RUE DE LOUVAIN, 38
BRUSSELS

The Right Hon. Lord DESBOROUGH, K.C.V.O.

PRESIDENT

of the

THIRTEENTH INTERNATIONAL NAVIGATION CONGRESS

LONDON 1923

- - Photogravure by - -
- Harper Woodhead and C° -
29, Paternoster Row, London.

The Right Hon. Lord DESBOROUGH, K.C.V.O.

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Hesborough

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PREFACE

The XIIIth International Congress of Navigation was held in London from the 2nd to the 7th of July 1923, under the High Patronage of His Majesty King George V. It was organised thanks to the co-operation of the British Government by the Permanent International Association of Navigation Congresses, having its seat at Brussels, by virtue of article 4 of the statutes.

The International Commission composed of Members belonging to the various countries, represented on the Association, and a local organizing Commission in London, formed to make the necessary preparations for the Congress and which held office till the close of the latter, drew up the programme for the Congress, and have provided for its entire realization.

The London Congress is thus the 4th application made with a brilliant success, of the active co-operation of a double organization of which the attributions are very distinct; on one hand, the Permanent International Commission, which has the entire management of the Association, which governs its actions, and bears the responsibility, which intervenes supremely in its conduct and its decisions, which sees to the increase of its financial and technical power, and on the other hand, the Local Commission of which the duration and the attributions are limited to a session of Congress and of which the special sphere extends chiefly to the measures of a local order combined and prepared in view of the better installation and good working of the new session.

At the Annual Meeting of the Permanent Commission held at Brussels, the 18th June 1920, the desire was expressed that the next Congress should be held in London, and Sir Cecil Hertslet, K. B. E., Representative of Great Britain on this Commission,

undertook to convey the wishes of his Colleagues to the Authorities in Great Britain.

Subsequently, His Majesty's Government and the Institution of Civil Engineers were approached and the Council of the Institution undertook to assist in the formation of a Local Organizing Committee for the purpose of carrying through the arrangements in order that the Congress should take place in the Summer of 1922, but the Council of the Institution intimated that they considered it desirable to hold the Congress a year later, in 1923.

The Council of the Institution invited The Right Hon. Lord Desborough, K.C.V.O., Chairman of the Thames Conservancy Board, to become President of the Congress. Lord Desborough assented and it must here be recorded that the choice was a most fortunate one because Lord Desborough, soon after his appointment, threw himself wholeheartedly into the work connected with the preparations for the Congress and it is chiefly due to his efforts that so much support was given by so many in Great Britain.

The Council of the Institution also invited Mr. R. B. Dunwoody, O.B.E., A. M. Inst. C. E., F.R.G.S., to act as Honorary Secretary of the British Committee and with the permission of the President and Council of the Association of British Chambers of Commerce, of which he is Secretary, Mr. Dunwoody was able to undertake the duties. He had acted as Secretary of the Royal Commission on Canals and Waterways 1906-1911 and of the Canal Control Committee of the British Government during the War.

Mr. Dunwoody appointed Mr. I. J. Thatcher, A.M. Inst. C.E., A.M.I.M.E., as Honorary Assistant Secretary. Mr. Thatcher had previously assisted him on the Royal Commission above referred to and with the permission of the Port of London Authority Mr. Thatcher was able to take up the work.

An Inland Navigation Congress was held in Manchester in the year 1890 and a Maritime Congress was held in London in 1893, both of which took place before the fusion into and constitution of the present Permanent International Association. In view of the importance of all questions of Inland and Ocean Navig-

From a painting by George Harcourt, A.R.A.

SIR MAURICE FITZMAURICE, C.M.G., F.R.S.

(Past President of the Institution of Civil Engineers)

VICE-PRESIDENT OF THE 13TH INTERNATIONAL NAVIGATION CONGRESS, LONDON, 1923.

conveyed to the Executive Council to be submitted for approval by the Permanent Commission they were accepted at the Meeting of the latter held at Brussels 7th June 1922, wich Sir Cecil Hertslet, Sir Maurice Fitzmaurice and Mr. Dunwoody attended, and they subsequently formed the subjects laid down in the programme of the Congress, of which we shall give particulars further on.

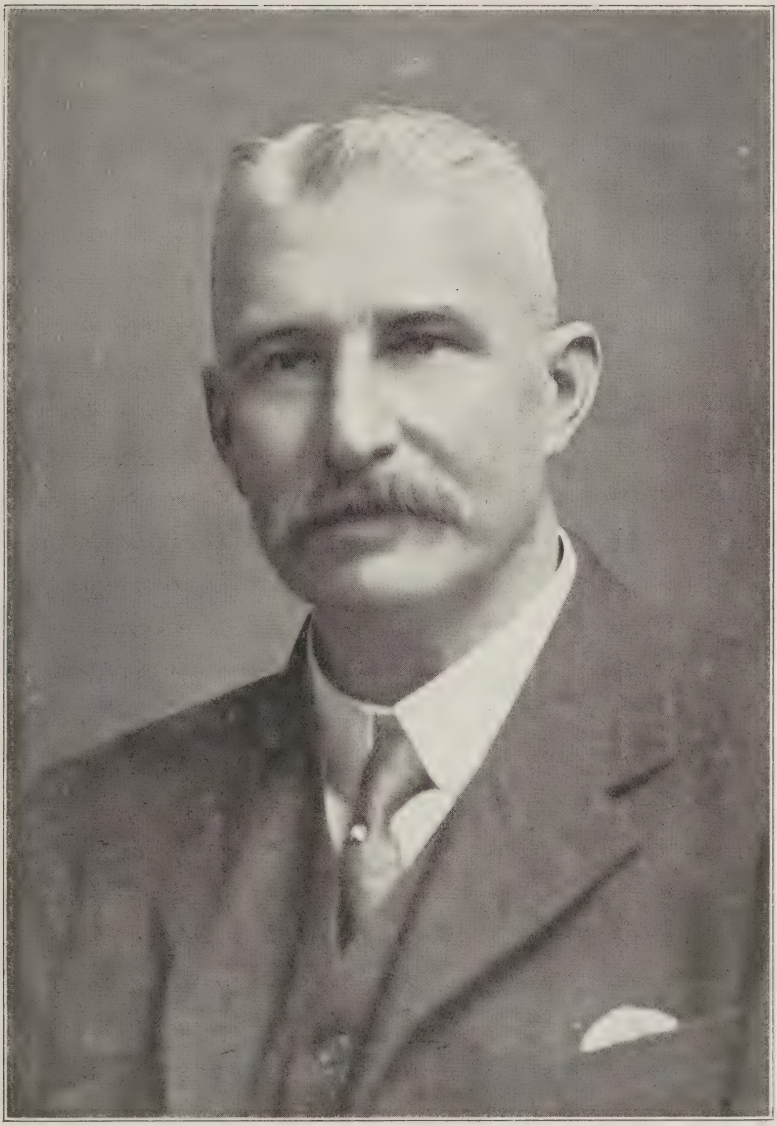
The Executive Committee of the Association with a view to ensuring the technical success of the Congress took in hand the selection of the reporters. By the 15th of June, the necessary steps had been taken to this end, in Belgium, and the cooperation of heads of delegations of the various countries represented on the Permanent Commission were solicited by special circular.

This co-operation was granted with the most praiseworthy promptness, and the Secretary's Office received rapidly numerous adhesions. In its turn the British Committee according to article 13 of the Regulations, submitted to the Commission of the Permanent Association, the names of the candidates called upon to draw up individual reports for Great Britain as well as the names of the General Reporters.

The number of ordinary reports was at first 83, this figure was brought down to 79, either by the desistance of their authors, or the impossibility of producing in the time desired, certain reports which had been announced. By adding 11 General Reports, the large number of 90 reports was reached, printed in English and French. Although the work of printing was considerable, it was completed in the time allowed by the Regulations, that is to say, sufficiently in time for the collection of reports to be sent out before the Congress to the Permanent Members of the Association and to the Temporary Members of the Congress. The task of the General Secretary of the Association was greatly facilitated by the obligingness of the reporters, most of whom kindly sent three copies of their report.

The Executive Committee makes a point of thanking here all the Reporters, ordinary and general for the assistance they have given to the Association in order to contribute to the technical success of the meeting.

Among the steps which were taken by the British Committee in



SIR ERNEST GLOVER, BART.,
PRESIDENT, CHAMBER OF SHIPPING OF THE UNITED KINGDOM
CHAIRMAN, OCEAN NAVIGATION SECTION
XIIITH INTERNATIONAL NAVIGATION CONGRESS,
LONDON, JULY 1923.

tee were glad to hear how greatly these entertainments were appreciated by all who took part in them.

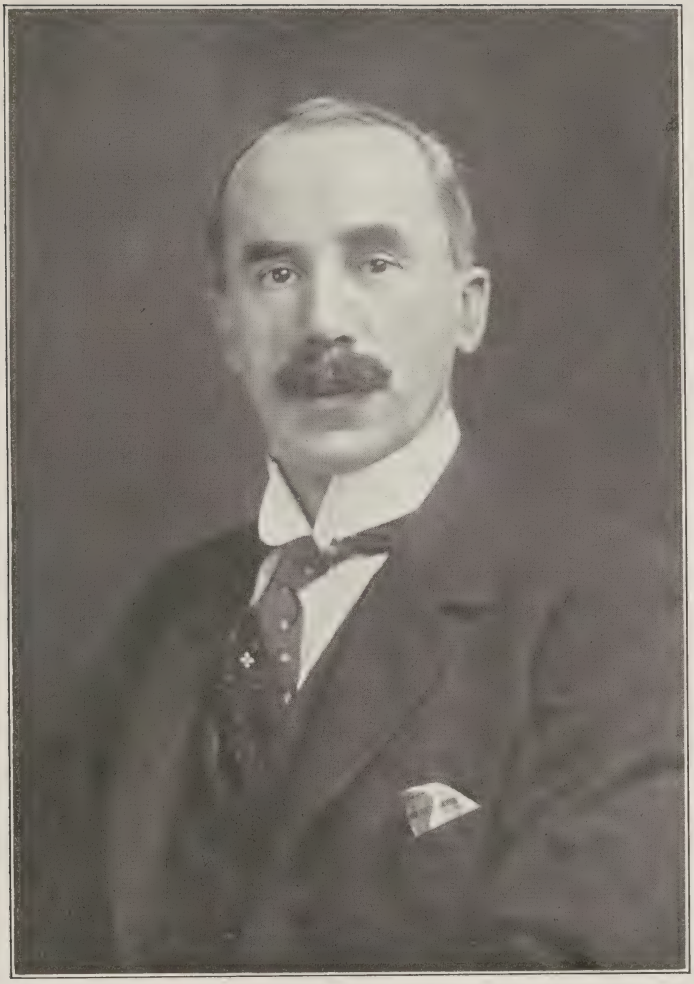
The Committee had great pleasure in entertaining the delegates and members at dinner soon after the opening of the Congress. They were also able to arrange for the entertainment of the ladies accompanying the delegates including visits to the important Galleries, Museums and public buildings in London. Many delegates inspected some important works of the London County Council such as the Blackwall Tunnel, while others visited the Houses of Parliament and the Zoological Gardens.

The Committee desire to thank the Directors of the National Physical Laboratory, the Aire and Calder Navigation Company, Messrs Hadfield Limited (Sheffield), the Humber Conservancy Board, the Birmingham Canal Company, the Clyde Navigation Trustees and the Leith Harbour Trustees for extending invitations to the delegates which unfortunately could not be accepted owing to the limited time which the delegates had in England.

The Committee compiled a special programme of the Congress containing a complete list of the Vice-Presidents and the Members of the Committee and of the General Reporters and Reporters to the Congress; a detailed time table and programme of the proceedings and a list of members attending the Congress, with particulars of the facilities arranged. This programme was greatly appreciated in the form in which it was presented. A special card of membership was also issued. A copy of the programme was addressed to each delegate and member attending the Congress and it was preceded by a message of welcome from Lord Desborough in which he said he trusted that with the help and support of each delegate and member, the discussions of the important subjects which were on the programme would result in advancing the progress of inland and ocean navigation and in increasing the prosperity of all countries.

There can be little doubt that the Congress which took place in London in 1923 was among one of the most representative, practical and useful of its kind which has yet been held.

The British Committee feel sure that the papers which were contributed and the discussions which took place and are reported hereafter, will prove of the greatest possible value to all who are



R. B. DUNWOODY, O.B.E
Hon General Secretary
XIIIth International Navigation Congress
London, 1923.

engaged in transport by sea and land and they trust that the efforts which they made to make the Congress a success will result, as Lord Desborough hoped, in adding to the knowledge of all who are engaged in transport throughout the World and by means of that new knowledge which has been so obtained, in increasing the prosperity of all the countries.

The Congress commenced at the Institution of Civil Engineers on Monday morning, July 2nd, when before a large gathering of delegates and members in the Great Hall of the Institution of Civil Engineers, the proceedings were formaly opened by His Royal Highness The Duke of York, K.G., K.T.

On behalf of the Permanent International Association of Navigation Congresses, a delegation headed by M. Gevaert and M. Lambin, respectively President and General Secretary of the Association, attended at Westminster Abbey on Monday morning 2nd July in order to lay a wreath upon the tomb of the Unknown Warrior. The Dean of Westminster presided at the ceremony.

On Tuesday morning, July 3rd, the French Delegation to the XIIIth International Congress of Navigation, headed by its President, M. Mahieu, Secrétaire Général au Ministère des Travaux publics at Paris, placed a sheaf of flowers on the tomb of the Unknown Warrior. The Dean of Westminster presided the ceremony.

The British Organising Committee desire to record their warm thanks to the President and Council of the Institution of Civil Engineers for the great assistance which the Institution rendered to the Congress in placing at its disposal the use of the halls and rooms of the Institution. The building was an ideal one in which to hold such a Congress and its success was in a large part due to the fact that the meetings were held in such commodious surroundings.

Official Opening of the XIIIth International Navigation Congress.
By H.R.H. The Duke of York, K.G., K.T., on 2nd July, 1923.
at the Institution of Civil Engineers, London.

GENERAL INFORMATION

XIII[th] INTERNATIONAL CONGRESS OF NAVIGATION

held in LONDON in 1923

UNDER THE HIGH PATRONAGE

OF

HIS MAJESTY KING GEORGE V

PRESIDENT :

The Right Hon. Lord DESBOROUGH, K.C.V.O.

DEPUTY PRESIDENT :

Sir Maurice FITZMAURICE, C.M.G., F.R.S.

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The Right Hon. Lord **Desborough,** K.C.V.O.

Deputy President :

Sir Maurice **Fitzmaurice,** C.M.G., F.R.S.

Vice-Presidents :

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The Right Hon. A. **Bonar Law,** M.P.
The Most Noble The Marquess **Curzon of Kedleston,** K.G., G.C.S.I.,G.C.I.E., Secretary of State for Foreign Affairs.
The Most Noble The Marquess of **Crewe,** K.G., His Majesty's Ambassador to France.
The Right Hon. The Earl of **Derby,** K.G., G.C.V.O., Secretary of State for War.
The Right Hon. J. H. **Whitley,** M.P., Speaker.
The Right Hon. Sir Philip **Lloyd-Creame,** K.B.E., M.C., M.P., President of the Board of Trade.
The Right Hon. L. C. S. **Amery,** M.P., First Lord of the Admiralty.
The Right Hon. Sir Arthur **Griffith-Boscawen.**
The Right Hon. Neville **Chamberlain,** M.P., Minister of Health.
The Right Hon. Sir John **Baird,** Bt., C.M.G., D.S.O., M.P., First Commissioner of Works.
Colonel Wilfrid **Ashley,** M.P., Parliamentary Secretary, Ministry of Transport.
The Right Hon. The Earl of **Crawford and Balcarres,** K.T.
The Right Hon. Viscount **Lee of Fareham,** G.B.E., K.C.B.
The Right Hon. Viscount **Pirrie,** K.P.
The Right Hon. Viscount **Cowdray.**

The Right Hon. Viscount **Devonport.**
The Right Hon. Lord **Shuttleworth.**
The Right Hon. Lord **Weir.**
The Right Hon. Lord **Kylsant,** G.C.M.G.
The Right Hon. Sir Alfred **Mond,** Bt., M.P.
The Right Hon. Sir Robert **Horne,** G.B.E., K.C., M.P.
The Right Hon. The Lord Mayor of London.
The Right Hon. The Lord Provost of Edinburgh.
The Right Hon. The Lord Provost of Glasgow.
The Right Hon. The Lord Mayor of Birmingham.
The Right Hon. The Lord Mayor of Bristol.
The Right Hon. The Lord Mayor of Hull.
The Right Hon. The Lord Mayor of Liverpool.
The Right Hon. The Lord Mayor of Manchester.
Engineer Vice-Admiral Sir George G. **Goodwin,** K.C.B.
Sir Kenneth **Anderson,** Bt., K.C.M.G.
Sir Archibald **Denny,** Bt.
Sir Algernon **Firth,** Bt.
Sir Robert **Hadfield,** Bt., F.R.S., M.Inst.C.E.
The Hon. Sir Charles A. **Parsons,** K.C.B., F.R.S., D.Sc.
Sir Eustace H. W. T. **d'Eyncourt,** K.C.B., F.R.S.
Sir Alexander **Gibb,** G.B.E., C.B.
Captain Sir Acton **Blake,** R.N., K.C.M.G., K.C.V.O.
Sir John **Cadman,** K.C.M.G., D.Sc.
Sir Maurice **Fitzmaurice,** C.M.G., F.R.S., M.A.I., P.P.Inst.C.E.
Sir Westcott **Abell,** K.B.E., M.I.N.A.
Sir Arthur Shirley **Benn,** K.B.E., M.P.
Sir Cecil **Hertslet,** K.B.E. (*)
Sir John P. **Griffith,** M.A.I., P.Pres.Inst.C.E.
Mr. Arthur **Neal.**
Mr. Frederick **Palmer,** C.I.E.
The President of the Royal Society.
The President of the Institution of Civil Engineers.
The President of the Institution of Electrical Engineers.
The President of the Institution of Mechanical Engineers.

(*) *British Representative in the Permanent Council at Brussels of the Association of Navigation Congresses.*

The President of the Institution of Naval Architects.
The President of the Institute of Transport .
The President of the Association of British Chambers of Commerce.
The President of the Chamber of Shipping of the United Kingdom.
The Chairman of the Port of London Authority.
The Chairman of the Belfast Harbour Commission.
The Chairman of the Port of Bristol.
The Chairman of the Clyde Navigation Trust.
The Chairman of the Humber Conservancy Board.
The Chairman of the Manchester Ship Canal Company.
The Chairman of the Mersey Dock and Harbour Board.
The Chairman of the Dover Harbour Board.
The Chairman of the Weaver Navigation Trustees.
The Chairman of Lloyd's.
The President of the Canal Association.

Members of British Organising Committee.

The President.
The Vice-Presidents.
The Honorary Treasurer.
The General Secretaries.

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Ministry of Transport — Mr. J. R. **Brooke,** C.B. (Principal Assistant Secretary), British Representative in the Permanent Council at Brussels of the Association of Navigation Congresses.
Board of Trade — Mr. G. R. **Baker** (Deputy Assistant Secretary, Mercantile Marine Department).
Admiralty — Mr. L. H. **Savile,** M.Inst.C.E. (Civil Engineer-in-Chief, Admiralty Works Department).
The Corporation of Trinity House — Capt. Sir Acton **Blake,** K. C.M.G., K.C.V.O.

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Mersey Dock and Harbour Board — Mr. L.A.P. **Warner,** C.B.E. (General Manager and Secretary).

Bristol Docks — Mr. D. Ross **Johnson,** C.B.E. (General Manager and Secretary).

Belfast Harbour Commission — Mr. M. J. **Watkins** (General Manager).

Great Western Railway Docks — Mr. J. H. **Vickery** (Chief Docks Manager).

Representatives of Canal and Navigation Companies:

Aire and Calder Navigation — Sir John **Eaglesome,** K.C.M.G., M.Inst.C.E.

Trent Navigation — Lt.-Col. F. **Rayner** D.S.O., A.M.Inst..C.E. (Engineer).

Thames Conservancy — Mr. G. J. **Griffiths,** M.Inst. C.E. (Engineer).

Lee Conservancy Board — Mr. S. R. **Hobday** (Secretary); Mr. C. N. **Tween,** M.Inst.C.E. (Engineer).

Manchester Ship Canal and Bridgwater Canals — Mr. H. A. **Reed,** M.Inst.C.E. (Engineer).

Weaver Navigation — Colonel J. A. **Saner,** V.D., M.Inst.C.E. (Engineer).

Grand Junction Canal — Mr. R. F. **de Salis** (Chairman).

Severn Commission — Mr. J. Willis **Bund** (Chairman).

Canal Association — Mr. A. J. **Butler** (Chairman of Committee).

Representatives of Shipping Companies:

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Sir Arthur Munro **Sutherland,** Bt., K.B.E.

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London & North Western Railway Company — Mr. E. F. **Crosbie Trench,** C.B.E., M.Inst.C.E. (Engineer).

Great Western Railway — Mr. W. W. **Crierson,** C.B.E., M.Inst. C.E. (Engineer).

London and North Eastern Railway — Sir J. R. **Nicholson,** C.M. G., M.Inst.C.E.

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Institution of Mechanical Engineers — Brig.-Gen. Magnus **Mowat,** C.B.E. (Secretary).

Institution of Electrical Engineers — Mr. Frank **Gill,** M.Inst.C.E.

Institution of Naval Architects — Mr. R. W. **Dana,** O.B.E. (Secretary).

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The Institute of Transport — Mr. Sidney **Preston,** C.I.E., C.B.E.

The Imperial Merchant Service Guild — Mr. T. W. **Moore,** C.B.E.

The North East Coast Institution of Engineers and Shipbuilders, Newcastle-on-Tyne — Mr. E. W. Fraser **Smith** (Secretary).

Institution of Engineers and Shipbuilders in Scotland — Mr. Edward H. **Parker** (Secretary).

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Chamber of Shipping — Mr. H. M. **Cleminson** (General Manager).

London Chamber of Commerce — Mr. Stanley **Machin,** J. P. (Ex-President).

Birmingham Chamber of Commerce — Mr. G. Henry **Wright** (Secretary).

Manchester Chamber of Commerce — Col. J. **Nall,** D.S.O., M.P.
Glasgow Chamber of Commerce — Sir W. F. **Russell,** J.P. (Ex-President).
Hull Chamber of Commerce — Sir H. **Samman,** Bt. (Ex-President).

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Admiral Henry **Campbell,** C.B., C.V.O.
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Mr. G. E. W. **Cruttwell,** M.Inst.C.E.
Mr. Wm. **Brown,** C.B.E., M.Inst.C.E.
Mr. A. **Butterfield,** M.Inst.C.E.
Mr. P. **Donald,** M.Inst.C.E.
Mr. C. S. **Meik,** M.Inst.C.E.

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Sir Albert **Wyon,** K.B.E. (Price, Waterhouse & Co.).

Honorary General Secretary :

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Mr. I. J. **Thatcher,** A.M.Inst.C.E. (*Assistant Honorary General Secretary*).

Assistant Secretary :

Mr. Verner W. **Macassey,** A.M.Inst.C.E.

Lady Secretaries :

Miss **Pettinger,** at the Institution of Civil Engineers, Westminster, S.W.
Miss **Tardif,** 14, Queen Annes Gate, S.W.

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General President-Deputy President and General Secretary

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Sir Maurice **Fitzmaurice,** C.M.G. F.R.S. (*Deputy President*).

R. B. **Dunwoody,** O.B.E., A. M. Inst. C.E. (*Honorary General Secretary*).

President and General Secretary of the Permanent International Association of Navigation Congresses.

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Lambin (*General Secretary*), Inspecteur Général des Ponts et Chaussées, Directeur Général à l'Administration Centrale.

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Algiers

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Belgium

Bouckaert, Inspecteur Général des Ponts et Chaussées, Directeur Général des Voies Hydrauliques, Brussels.

Brazil

Buriamaqui, Ingénieur fédéral des Ports, Fleuves et Canaux, à Botafoga (Rio de Janeiro).

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Dr. **Pyau Ling**, Premier Secrétaire de la Légation de la République Chinoise, Brussels.

Denmark

C. F. **Lillelund**, Directeur des Travaux Maritimes de l'Etat Danois, Copenhague.

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Maese y Pena, Inspecteur Général des Routes, Canaux et Ports, Valencia.

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K. **Snellman**, Directeur Général de l'Administration des Voies de Communication, Helsingfors.

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Greece

G. **Panas**, Capitaine de Vaisseau, Attaché Naval à la Légation Hellénique de Londres.

Ungary

Nandor **de Szabo,** Chef de bureau, Inspecteur des travaux hydrauliques au Ministère de l'Agriculture, Budapest.

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H. A. F. **Lindsay,** C.B.E., India Trade Commissioner in London.

Ireland

Captain M.H. **Clarke,** F.R.A.S., Chief Marine Surveyor, Dublin.

Italy

E. **Sanjust di Teulada,** Inspecteur Supérieur du Génie Civil, ancien Sous-Secrétaire d'Etat, Sénateur, Rome.

Japan

Teisuke Harada, Chief Engineer of the Department of Home Affairs, Tokio.

Monaco

Butavand, Ingénieur en Chef des Ponts et Chaussées, Conseiller de Gouvernement pour les Travaux Publics.

Norway

Stuevold-Hansen, Director General, Christiania.

Holland

H. **Wortman,** Inspecteur Général du Rijkswaterstaat e. c., Directeur Général des Travaux du Zuyderzee, The Hague.

Poland

Swirski, J., Capitaine de Vaisseau.

Roumania

G. **Popesco,** Directeur Général des Ports et des Voies de Communication par eau, Bucarest.

Russia

V. E. **Timonoff,** Secrétaire Général du XI[e] Congrès International de Navigation.

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du Plessis de Richelieu, A., (Phya Cholayn Yothin), Vice-Amiral, Copenhague.

Sweden

F.W. **Hansen,** Directeur Général de l'Administration Royale des Forces Hydrauliques et des Canaux, Stockholm.

Switzerland

C. **Mutzner,** Directeur du Service fédéral des Eaux, Berne.

Czechoslovakia

B. **Muller,** Ingénieur, Ministre plénipotentiaire, Délégué de la République Tchécoslovaque aux Commissions Internationales du Danube, de l'Elbe et de l'Oder, Secrétaire d'Etat au Ministère des Travaux Publics, Prague.

Tunis

Gosselin, Ingénieur principal des Travaux Publics, Sousse.

Union South Africa

Bowden, Director of Shipping, Office of High Commissioner, London.

Uruguay

His Excellency Senor Don Frederico R. **Vidiella,** Minister to Great Britain, London.

Central Rhine Commission

Charguéraud, Inspecteur Général des Ponts et Chaussées, Président de la Commission Centrale pour la Navigation du Rhin, Paris.

European Commission of the Danube

John **Grey Baldwin,** Ministre Plénipotentiaire, Délégué de la Grande-Bretagne à la Commission Européenne du Danube, Foreign Office, London.

International Commission of the Elbe

B. **Muller,** Ingénieur, Ministre Plénipotentiaire, Délégué de la République Tchécoslovaque aux Commissions Internationales du Danube, de l'Elbe et de l'Oder, Secrétaire d'Etat au Ministère des Travaux Publics, Prague.

International Commission of the Danube

Admiral Sir E.C.T. **Troubridge,** K.C.M.G., C.B., M.V.O., Délégué de Grande-Bretagne à la Commission Internationale du Danube.

Suez Canal Company

Quellennec, Ingénieur Conseil de la Compagnie Universelle du Canal Maritime de Suez, Paris.

League of Nations

(Consultative and technical Commission of Communications and Transit.)

Montarroyos, Président de la Sous-Commission des Transports par Eau, Carrières-sur-Seine, France.

Secretaries :

Belgium

L. **Van Wetter,** Ingénieur en Chef, Directeur des Ponts et Chaussées, Liége.

France

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* Jan **Kobza,** Ingénieur, Conseiller Supérieur au Ministère des Travaux Publics, Prague.

* Antonin **Klir**, Dr. ès Sciences techniques, Professeur à l'Ecole Polytechnique Tchèque, Prague.

* Dr Jan **Smetana**, Docteur ès Sciences techniques, Ministère des Travaux Publics, Prague.

* Prof. Antonin **Smrcek**, Haute Ecole Technique, Brno.

Tunis

Marcel **Cosselin,** Ingénieur principal des Travaux publics, Sousse.

Uruguay

Carlos **Albin,** Calle 25 de Agosta, Montevideo.

J. C. **Gomez,** Montevideo

His Excellency Señor Don F. R. **Vidiella,** Minister to Great Britain, 3, Elvaston Place, S.W. 1.

PROGRAMME OF WORKS

AND

NAMES OF REPORTERS

VARIOUS PUBLICATIONS

MODELS AND EXHIBITS

DISPOSITION OF THE TIME

List of General Reporters and Writers of Papers on the Questions and Communications

FIRST SECTION. — INLAND NAVIGATION

N° 1 QUESTION

Utilisation of Waterways for the production of power; its consequences and applications.

(1)* General Reporter : Sir John P. **Griffith,** M.A.I.
Past President of the Institution of Civil Engineers, Former Member of the Royal Commission on Canals and Waterways.
Late Engineer to the Port of Dublin.
Member of the Board of Trade Committee on Water Power Resources, and Chairman of the Water Power Resources of Ireland Sub-Committee.

Reports by :

(1 *bis*) United States : Colonel William **Kelly,** Corps of Engineers, U.S. Army, Chief Engineer Federal Power Commission.

(2) France: M. L. **Armand,** Inspecteur Général des Ponts et Chaussées, Paris.

(3) Great Britain : Mr, W. J. E. **Binnie,** M.Inst.C.E., Consulting Civil Engineer, London.

Mr. C. S. **Meik,** M.Inst.C.E., Consulting Civil Engineer, London, and

* The numbers given appear on the printed Reports.

Mr. J. W. **Twinberrow,** M.Inst.C.E., Consulting Civil Engineer, Dursley, Glos.

Mr. G. L. **Addenbrooke,** M.Inst.C.E., Consulting Electrical Engineer, London, W.

Mr. R. F. **Hindmarsh,** M.Inst.C.E., Chief Engineer Tyne Improvement Commission, Newcastle-on-Tyne.

(4) ITALY : M. **Pallucchini,** CAV. UFF., Anibale, Ingénieur, Bureau Royal du Génie, Milan.

(5) SWEDEN. — *In collaboration:* M. S. **Lubeck,** Député, Commandant au Corps Royal des Ponts et Chaussées, Ingénieur Conseil, Membre de l'Académie Royale des Sciences Techniques, Stockholm.

Mr. A. **Ekwall,** Capitaine au Corps Royal des Ponts et Chaussées, Directeur des Travaux de Construction de l'Administration Royale des Forces Hydrauliques et des Canaux, Membre de l'Académie Royale des Sciences Techniques, Stockholm.

(6) CZECHOSLOVAKIA. — *In collaboration :* M. **Smetana,** Docteur ès Sciences Techniques, Ingénieur Conseiller à l'Institut Hydrographique d'Etat, Prague.

M. **Pacak,** Ingénieur Conseiller au Bureau Hydrographique de Bohème, Prague.

M. **Tyll,** Ingénieur Conseiller au Service de Navigation de la Vltava et de l'Elbe, Prague.

N° 2 QUESTION.

Dispositions or arrangements to be adopted for locks, elevators, inclined planes, and other means of overcoming differences of level with a view to facilitating the operations.

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(7) General Reporter : Mr Sidney **Preston,** C.I.E., C.B.E., M.Inst.C.E

Former Secretary to Government of India Public Works Department and Inspector General of Irrigation.

Chairman of the Canal Control Committee, Ministry of Transport.

Technical Adviser to Ministry of Agriculture and Fisheries for Drainage and Reclamation.

Reports by :

(8) Belgium. — *In collaboration :* M. L. **Van Wetter,** Ingénieur en chef, Directeur des Ponts et Chaussées, Liége.

M. **Schoentjes,** Ingénieur Principal des Ponts et Chaussées, Ghent.

(8 *bis*) United States : Colonel Edward H. **Schulz,** Corps of Engineers, U.S. Army.

(9) France. — *In collaboration :* M. **Deval,** Ingénieur en chef des Ponts et Chaussées, Paris.

M. **Tumerelle,** Ingénieur en chef des Ponts et Chaussées, chez M. M. Schneider et Cie, Paris.

(10) Great-Britain : Mr. G. E. W. **Cruttwell,** M.Inst.C.E., Consulting Civil Engineer, Westminster.

Colonel J. A. **Saner,** V.D., M.Inst.C.E., Engineer, Weaver Navigation, Northwich, Cheshire.

Mr. G. J. **Griffiths,** M.Inst.C.E., Engineer, Thames Conservancy Board, London.

(11) Italy : M. **Casparini,** Direzione Lavori Linea Navigabile Po-Brondolo at Adria (Italy).

(12) Holland : M. R. L. **Wentholt,** Dr., Ingénieur en chef du Waterstaat, Nijmegen.

(13) Sweden. — *In collaboration :* M. **Vinberg,** Directeur du Port de Stockholm, Ancien Membre de l'Académie Royale des Sciences Techniques, Stockholm.

M. L. **Lawski,** Lieutenant au Corps Royal des Ponts et Chaussées, 1er ingénieur au Bureau de Construction des Canaux à l'Administration Royale des Forces Hydrauliques et des Canaux, Stockholm.

(14) Czechoslovakia : M. **Klir,** Docteur ès Sciences Techniques, Professeur à l'Ecole Polytechnique à Prague, Ancien Ingénieur en chef de la Commission pour la Canalisation de la Vltava et de l'Elbe en Bohème.

N° 1 COMMUNICATION

The influence of surface waters and subterranean sheets of water on the flow of rivers. Regime of mixed canals; estimation of the water consumed for navigation and irrigation uses; the portion returned to the subterranean sheet of water.

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(15) General Reporter : Mr. Edward **Sandeman,** M.Inst.C.E., Water Engineering to Plymouth, 1891-1900.

Chief Engineer to Derwent Valley Water Board, 1900.

During succeeding years carried out large works of water supply for Leicester, Derby, Nottingham, Sheffield, etc.

Reports by :

(15 *bis*) United States : Professor Daniel W. **Mead,** University of Wisconsin, Madison, Wisconsin.

(16) France : M. **Dienert,** Service d'Alimentation des Eaux de la Ville de Paris, Académie d'Agriculture, Préfecture de la Seine, Paris.

(17) Great-Britain : Mr. **de Carle Salter,** Superintendent, British Rainfall Organisation, Meteorological Office, London.

Mr. H. A. **Reed,** M.Inst.C.E., Chief Engineer Manchester Ship Canal Company, Manchester.

(19) Sweden : M. A. **Wallen,** Docteur ès Sciences, Directeur en chef du Service Météorologique et Hydrographique de Suède, Stockholm.

(20) Czechoslovakia. — *In collaboration:* **M. Kobza,** Ingénieur, Conseiller à la Section des Voies Navigables au Ministère des Travaux Publics, Prague.

M. **Hengenius,** Ingénieur, Conseiller au Ministère de l'Agriculture, Prague.

N° 2 COMMUNICATION

Unification of statistics of Inland Navigation with a view to facilitating the comparison of the results of the working of navigable Waterways in various countries.

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(21) General Reporter: Mr. H. **Eneborg,** D.Sc., Chief Editor of the Royal Administration Journal of Commerce, Kungl. Kommerskollegium at Stockholm.

Reports by :

(21 *bis*) United States : Dr. Grover G. **Huebner,** University of Pennsylvania, Philadelphia, Pa.

(22) France : M. **de Kerviler,** Ingénieur en chef des Ponts et Chaussées, Paris.

(23) Italy : M. Prof. Archinto **Berni,** Comitato Mantovano per la Navigazione interna presso la Camera di Commercio, Mantova.

(24) Holland : M. J. H. F. **Claessens,** Administrateur, Chef de Section du Bureau Central de Statistiques, La Haye.

(25) Sweden : M. H. **Eneborg,** D.Sc., Chief Editor of the Royal Administration Journal of Commerce, Stockholm.

(26) Czechoslovakia : M. **Partl,** D.Sc., Conseiller à la Section de Navigation du Ministère du Commerce, Prague.

SECOND SECTION. — OCEAN NAVIGATION

N° 1 QUESTION.

The accomodation to be provided for ships in connection with the construction of new works at ports in order to satisfy the future dimensions of ships.

(27) General Reporter : Mr. L. H. **Savile,** M.Inst.C.E.
Civil Engineer-in-Chief, Admiralty Works Department, London.

Reports by :

(28) Belgium. — *In collaboration:* M. L. **Bonnet,** Ingénieur en chef, Directeur des Ponts et Chaussées, Antwerp.

M. F. **Urbain,** Hydrographe Principal, Antwerp.

(29) China : M. H. **von Heidenstam,** Captain, Royal Swedish Engineers, M.Inst.C.E., M.A.Soc.C.E., Engineer-in-Chief, Whangpoo Conservancy Board, Shanghai.

(30) Denmark : M. G. **Lorenz,** Ingénieur en chef du Port de Copenhagen, Copenhagen.

(30 *bis*) United States : Captain F. **Chambers,** C.E.C., U.S. Navy, c/o Board of Engineers for R. and H., Washington, D.C.

(31) France : M. G. **Clavel,** Inspecteur Général des Ponts et Chaussées, Bordeaux (Gironde).

(32) *Book No.* 1 — Great Britain :

Sir Cyril R. S. **Kirkpatrick,** M.Inst.C.E., Engineer-in-Chief, Port of London Authority, London.

Mr. L. H. **Savile,** M.Inst.C.E., Civil Engineer-in-Chief, Admiralty, London.

Mr. F. E. **Wentworth-Sheilds,** O.B.E., M. Inst.C.E., Engineer, Southern Railway, Dock Department, Southampton.

(33) *Book No. 2*

Sir John **Biles,** K.C.I.E., LL.D., D.Sc., M. Inst.C.E., Hon. Vice-Pres. Inst. of Naval Architects, Naval Architect and Engineer, Consulting Naval Architect to H.M. India Office, Westminster.

Sir Westcott S. **Abell,** K.B.E., M.I.N.A., M. Inst.C.E., M. Eng. (Liverpool), Chief Ship Surveyor, Lloyd's Register of Shipping, Member of Council of Institution of Naval Architects, London.

Mr. J. Foster **King,** C.B.E., M.Inst.C.E., Chief Surveyor to the British Corporation for the Registration of Shipping, Glasgow.

(34) *Book No 3*

Mr. Adam **Scott,** M.Inst.C.E., (the late), Consulting Civil Engineer, London.

Mr. T. S. **Gilbert,** B.E., (Royal), M.Inst.C. E., Engineer, Harbour Office, Belfast.

Mr. N. G. **Cedye,** O.B.E., B.Sc., M.Inst.C. E. Consulting Civil Engineer, London.

Mr. S. Alfred **Frech,** M.Inst.C.E., Consulting Civil Engineer, London.

(35) ITALY : M. **Luiggi,** Ing. Prof. Luigi, Deputato al Parlamento, Ispettore Superiore del Genio Civile, Ministero dei Lavori Publici, Rome.

(36) HOLLAND : Mr. D. **Boomsma,** Ingénieur en chef des Travaux du Port de Rotterdam.

(37) SWEDEN : M. P. G. **Hörnell,** Ingénieur Conseil, Membre de l'Académie Royale des Sciences Techniques, Stockholm.

N° 2 QUESTION.

Types of works for berthing ships of great draught in tidal seas.

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(38) General Reporter : Mr. M. F. G. **Wilson,** M.Inst.C.E.
Partner in the firm of Coode, Fitzmaurice, Wilson & Mitchell, Consulting Civil Engineers, Westminster.

Reports by :

(39) Belgium. — *In collaboration* : M. L. **Bonnet,** Ingénieur en chef, Directeur des Ponts et Chaussées, Antwerp.

M. **Braeckman,** Ingénieur des Ponts et Chaussées, Antwerp.

(39 *bis*) United States : Captain F. **Chambers,** C.E.C., U.S. Navy, Washington, D.C.

(40) France : M. **Outrey,** Ingénieur des Ponts et Chaussées, Le Havre.

(41) Great-Britain : Mr. M. F. G. **Wilson,** M.Inst.C.E., Consulting Civil Engineer, London.

Mr. A. T. **Walmisley,** M.Inst.C.E. (the late), Harbour Engineer, Dover.

(42) Holland : Mr. D. **Boomsma,** Ingénieur en chef des Travaux du Port de Rotterdam.

N° 3 QUESTION.

The relative advantages of ship equipment and port equipment for loading and discharging ships. Mechanical equipment of ports, mechanical handling of freight. Loading, discharging and carrying between ships and the various depositing points, whether covered by sheds or not.

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(43) General Reporter : Mr. H. J. **Deane,** M.Inst.C.E.
Chief Assistant Engineer to the Port of London Authority.

Reports by :

(44) Spain. — M. Eduardo **de Castro,** Ingeniero de Caminos Canales y Puerto, Gijon.

(45) France. — *In collaboration :* M. **de Pelissot,** Directeur Honoraire Conseil de la Compagnie des Docks et Entrepôts de Marseille, Marseilles.

M. **Alexis,** Ingénieur de la Compagnie des Docks et Entrepôts de Marseille, Marseilles.

M. **Barrillon,** Ingénieur en chef des Ponts et Chaussées, Rouen.

Great Britain :

(46) *Book No* 1

Dr. Brysson **Cunningham,** D.Sc., B.E., M. Inst.C.E., Consulting Civil Engineer, London.

Mr. A. R. T. **Woods,** M.I.N.A., London.

Mr. Ernest J. **Buckton,** B.Sc.,A.M.Inst.C.E., Buenos-Aires, Argentina.

(47) *Book No* 2

Mr. Somers H. **Ellis,** M.Inst.C.E., Messrs. Alfred Holt & Co., Liverpool.

Mr. H. H. G. **Mitchell,** O.B.E., M.Inst.C.E., Consulting Civil Engineer, London.

Mr. Thomas A. **Peace,** M.Sc.,A.M.Inst.C.E., Engineer, Port of Bristol, Avonmouth.

(48) Italy. — M. **Albertazzi,** Cav. Uff., Ing. Ariberto, Chef de Service du Génie Civil près le Consortium du Port, Genoa.

(49) Holland. — *In collaboration :* M. H. **de Roode,** Directeur Adjoint, and

M. J. J. **Sprenger,** Ingénieur des Travaux Publics de la Ville de Rotterdam.

(50) Sweden. — *In collaboration:* M. **Lundberg,** A., Commandant au Corps Royal des Ponts et Chaussées, Ingénieur en chef du Port de Stockholm.

M. **Davidsson,** W., Ingénieur mécanicien à la Direction du Port de Stockholm, Stockholm.

N° 1 COMMUNICATION

Concrete and reinforced concrete. Their applications to hydraulic works; means to insure their preservation and their watertightness.

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(51) General Reporter Mr. G. W. **Humphreys,** C.B.E., M.Inst. C.E. Chief Engineer to the London County Council.

Reports by :

(52) BELGIUM. — *In collaboration*: M. **Derycke,** Ingénieur en chef Directeur des Ponts et Chaussées, Ghent.

M. **Haché,** Ingénieur Principal des Ponts et Chaussées, Ghent.

M. **Goossens,** Ingénieur Principal des Ponts et Chaussées, Mont Saint Amand.

(53) DENMARK. — *In collaboration :* M. J. J. **Munch-Petersen,** Ingénieur, Professeur à l'Ecole Polytechnique de Copenhagen, Copenhagen.

M. A. **Poulsen,** Ingénieur en chef des Travaux Maritimes de l'Etat Danois, Copenhagen.

(54) SPAIN. — *In collaboration* : M. **Becerra,** Ingénieur des Routes, Canaux et Ports, Directeur des Travaux du Port de Musel, Gijon.

M. **Maese de la Pena,** Inspecteur général des Routes, Canaux et Ports, Directeur des Travaux du Port de Valencia.

M. Delgado **Brackenbury,** Ingénieur des Routes, Canaux et Ports, Directeur des Travaux du Port de Séville, Séville.

M. E. **de Castro,** Ingeniero de Caminos y Puertos, Gijon.

(55) FRANCE. — M. **Voisin,** Inspecteur Général des Ponts et Chaussées, Paris.

GREAT BRITAIN :

Mr. S. D. **Carothers,** A.M.Inst.C.E., Civil Engineer-in-Chief's Department, Admiralty, London.

Mr James **Mitchell,** M.Inst.C.E., Aberdeen.

(56) *Book No* 1

Mr. William **Cleaver,** M.Inst.C.E., Resident Docks Engineer, Great Western Railway's Alexandra Docks, Newport, Mon.

Mr. J. Mitchell **Moncrieff,** C.B.E., M.Inst. C.E., Consulting Civil Engineer, London.

(56*bis*) *Book No* 2

Sir Robert **Hadfield,** Bt., D.Sc., F.R.S., M. Inst.C.E., London.

(58) JAPAN. — *In collaboration* : Mr. Kyjoichi **Aki,** Ingénieur, Directeur des Travaux du Port de Yokohama, Engineering Office, Bureau Public Works, Home Department, Tokio

Mr. M. S. **Okabe,** Ingénieur du Service du Port de Yokohama.

(59) HOLLAND. — *In collaboration :* Mr. J. A. **Ringers,** Ingénieur en chef du Rykswaterstaat;

Mr. **Telegen,** Ingénieur du Rykswaterstaat.

(60) SWEDEN : M. **Petterson,** K., Capitaine au Corps Royal des Ponts et Chaussées, Ingénieur en chef du Port de Gothenbourg.

N° 2 COMMUNICATION.

Use of liquid fuel for navigation and its consequences.

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(61) General Reporter : Sir John **Cadman,** K.C.M.G., D.Sc., M. Inst.C.E.
Technical Adviser to the Anglo-Persian Oil Company.
Member of Council of Department of Scientific and Industrial Research.
President Institution of Mining Engineers.
Late Consulting Petroleum Adviser to His Majesty's Government.
Chairman of the Inter-Allied Petroleum Council.

Reports by ;

(61*bis*) CHILE : Senor Maximiliano **Prado,** Ingeniero 1° de la Armada.

(62) UNITED STATES: Commander Urban T. **Holmes,** U.S. Navy, Mem. Am. Soc.N.E.

(63) FRANCE. — *In collaboration* : M. **Boris,** Ingénieur en chef de la Marine, détaché à la Commission des Réparations, Paris.

M. **Bricard,** Ingénieur en chef de la Marine, Paris.

(64) GREAT BRITAIN : Captain A. E. **Hyne,** Engineer, C.M.G., Admiralty, London.

Mr. J. J. **Kermode,** Kermode's Ltd., Liverpool.

(65) ITALY : **Baulino,** Ing. Colonnello del Genio Navale, Uff. tecnico del genio navale, Genoa.

(66) ROUMANIA : M. **Popesco,** G., Directeur Général des Ports et des Voies de Communication par Eau, Bucarest.

(67) SWEDEN : M. **Seth,** Ingénieur Conseil, Gothembourg.

N° 3 COMMUNICATION

Utilisation of tides for the production of power for the working and lighting of ports and for maritime works (working of lock-gates, etc.).

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(68) General Reporter : Mr. C. S. **Meik,** M.Inst.C.E., Consulting Civil Engineer, Westminster.

Reports by ;

(68 *bis*) CHILE : Senor Alejandro **Yanquez,** Teniene 1° de la Armada.

(69) FRANCE : M. A. **de Rouville,** Ingénieur en chef des Ponts et Chaussées, Ingénieur en chef du Service des Phares et Balises, Paris.

(70) GREAT BRITAIN : Mr. Ernest **Latham,** M.Inst.C.E., Consulting Civil Engineer, London.

(71) ITALY : M. Francesco **Cattaneo,** Ing., T. Colonnello del Genio Navale, Stazione Sperimentale Forze Motrize Marine, Voltri.

(72) HOLLAND : Mr. W. J. H. **Harmsen,** Ingénieur du Waterstaat, Goes.

N° 4 COMMUNICATION.

Principal advances made recently in lighting, beaconing and signalling of coasts.—Standardisation (unification) of the languages of maritime signals.

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(73) General Reporter : Mr. D. W. **Hood,** C.B.E., M.Inst.C.E. Engineer-in-Chief, Corporation of Trinity House.

Reports by ;

(74) BELGIUM : M. **Urbain,** Hydrographe Principal à l'Administration des Ponts et Chaussées, Antwerp.

(75) Spain : M. **Serret y Mirete,** Ingénieur des Routes, Canaux et Ports, Ingénieur Ordinaire du Service Central des Signaux Maritimes, Madrid.

(76) United States : Mr. G. R. **Putnam,** Commissioner of Lighthouses, Department of Commerce, Washington, D.C.

(77) France. — *In collaboration* : M. **Blondel,** Ingénieur en chef des Ponts et Chaussées, attaché au Service Central des Phares et Balises, Membre de l'Institut, Paris.

M. A. **de Rouville,** Ingénieur en chef des Ponts et Chaussées, Ingénieur en chef du Service des Phares et Balises, Paris.

Great Britain :

(78) *Book No* 1

M. D. W. **Hood,** C.B.E., M.Inst.C.E., Chief Engineer, London, E.C.

Mr. Arthur **Butterfield,** M.Inst.C.E., Chief Engineer, Humber Conservancy Board, Hull.

Mr. W. J. **Curtis** and Mr. Robert **Steel,** The Gas Accumulator Co. (United Kingdom), Ltd., Lighthouse and Marine Lighting Engineers, Beacon Works, Brentford.

(79) *Book No* 2

Mr. D. Alan **Stevenson,** A.M.Inst.C.E., Consulting Civil Engineer, Edinburgh.

Captain H. **Browne,** O.B.E., R.N. (Retired), London, W.

(80) Italy : M. Aristide **Luria,** Prof., Tenento Colonnello del Genio Militare, Rome.

(81) Japan : Mr. Genji **Ishikawa,** Engineer, Bureau des Phares et des Communications, Département des Communications, Tokio.

(82) Holland : Mr. P. **van Braam van Vloten,** Ingénieur en chef du Service Technique des Phares, The Hague.

(83) Sweden : M. **Lundeberg,** F., Capitaine au Corps Royal des Ponts et Chaussées, Ingénieur en chef et Membre du Conseil de l'Administration Royale du Service des Phares, du Pilotage et du Sauvetage, Stockholm.

(84) Russia : Mr. S. **Scholkalsky,** Engineer, Moscow.

Various Publications

Publications distributed to Members of the Congress.

Programme of the Congress containing portraits of Lord Desborough, M. Helleputte and M. Lambin.

Hydrology of Sweden, by Alex Wallen, Published by Meteorological and Hydrological Service of Sweden.

La Navigation du Rhin, June Number of monthly publication by the Central Commission for the Navigation of the Rhine.

Hydraulic Laboratory in the Czechoslovak High School at Brun, by Prof. A. Smrcek (Printed in French and English).

Moderni tipi di Moli, by Prof. Ing. E. Coen Cagli (Italy).

A paper on the *1st Communication*, by M. Giandotti, in Italian.

Swedish Ports, published by A. B. Gunnar Tisseis Tekniska Forlag, Stockholm.

Four Brazilian publications as follows:

Portos do Brazil, 1822-1922.

Inspectoria federal de Portos, Rios e Canaes. Relatoria dos servicos relativos ao anno de 1920.

Inspectoria federal de Navegacao. Relatoria Anno de 1921 (Vols I and II).

Dock and Harbour Authority, July number of monthly publication (Great Britain).

Port of London Authority.

Sheet of statistics of the Port illustrative of its growth, etc., 1909-1922.

Particulars of Improvements and Extensions completed, under construction or proposed, in the Port of London since the establishment of Port of London Authority.

Southampton Docks.

Large illustrated brochure on the Port of Southampton (Southern Railway Company).

The South Wales Docks.

A specially printed brochure giving itinery of visit of Members of the Congress and maps of the South Wales Docks of the Great Western Railway Company.

Port of Bristol.

Official handbook published by the Corporation of the City of Bristol.

A specially printed brochure giving itinery of the visit of Members of the Congress and statistical data presented by the Corporation of Bristol.

A short history of the development and working of the Port of Bristol, presented by the Great Western Railway Company.

A Souvenir in the form of maps showing railway connections to the Port of Bristol, specially printed for the Congress and presented by the Great Western Railway Company.

Port of Liverpool.

An illustrated brochure on the Port of Liverpool, presented by the Mersey Docks and Harbour Board.

A pamphlet giving general description of the Gladstone System of Docks, presented by the Mersey Docks and Harbour Board.

Models and exhibits

The following is the list of the various models and exhibits which had been sent by various members of the Congress.

1. A model of the « Desborough » Boat Conveyor which has been constructed by the Thames Conservancy Board at Boulter's Lock.
   Exhibited by the Right Hon. Lord Desborough, K.C. V.O., President of the Congress.

2. Working models exhibited by Colonel F. Cattaneo (Italy) of Ondo Pumps, Tidal Basin, Differential Basin, in illustration of his Report on Communication n° 3 of the 2nd Section.

3. Model of Cutter Suction Reclamation Dredger by W^m^ Simons & Co. Ltd. exhibited by Sir John Biles, K.C.I.E., Naval Architect (Great Britain).

4. Model of Patent Cutter Dredger exhibited by Sir John Biles, K.C.I.E., Naval Architect (Great Britain).

5. New Electrical Water Level Indicator instrument by the Teleghron Electric Transmitter Co.

6. A diagram illustrating a method of course signalling for the prevention of collision at sea in foggy weather by Captain F. R. Harrold, R. N. (Great Britain).

7. A series of exhibits were also on view in illustration of the report by Sir Robert Hadfield, Bt. FRS. (Great Britain).

Programme of arrangements

Monday, July 2nd.

Morning

9 a.m. Meeting of the Permanent International Commission of Navigation Congresses.

10 a.m. Registration of Delegates and Members attending the Congress.

11 a.m. Meetings of the Committee of the Congress and Sectional Committees.

In the Great Hall. — Formal Opening of the Congress.

(*Morning Dress.*)

12 (Noon) (1) Opening of the Congress by H.R.H. The **Duke of York,** K.G., K.T.

(2) Address by the Right. Hon. Lord Desborough, K.C.V.O., President.

(3) Replies by the Chief Delegates of the countries represented.

Afternoon.

SECTIONAL MEETINGS

First Section, Inland Navigation. — Chairman ;
Right Hon. Lord **Desborough,** K.C.V.O.

3 p.m. Address by Chairman of Section.
Discussion of *Question No 1, viz.:*

1. The Utilisation of Waterways for the production of power; its consequences and applications.

Second Section, Ocean Navigation. — Chairman :
Sir Ernest **Clover,** Bart.

In Lecture Theatre

3 p.m. Address by Chairman of Section.
Discussion of *Questions N^os 1 and 2, viz. :*

1. — The accommodation to be provided for ships in connection with the construction of new works at ports in order to satisfy the future dimensions of ships.
2. — Types of works for berthing ships of great draught in tidal seas.

Evening :

7.30 p.m. — *Official Dinner to Members of the Permanent International Commission and Chief Delegates.*

10-11.30 p.m. — *Official Reception to Delegates and Members and Ladies attending the Congress.*
(*Evening Dress. — Decorations.*)

Tuesday, July 3rd.

SECTIONAL MEETINGS

First Section, Inland Navigation. — Chairman :
Lord **Desborough**, K.C.V.O.

In Great Hall.

10 a.m. Discussion continued of *Questions N^os 1 and 2, viz.:*

1. — Utilisation of Waterways for the production of power; its consequences and applications.

1 p.m. Adjournment.

Chairman : Sir Maurice **Fitzmaurice,** C. M. G., F. R. S.

2.30 p.m. Discussion of *Questions N° 2, viz:*

2. — Dispositions or arrangements to be adopted for locks, elevators, inclined planes, and other means of overcoming differences of level with a view to facilitating the operations.

Second Section, Ocean Navigation. — Chairman :

Sir Ernest **Clover,** Bart.

In Lecture Theatre

10 a.m. Discussion continued of *Questions N^os^ 1 and 2, viz.:*

1. — The accommodation to be provided for ships in connection with the construction of new works at Ports in order to satisfy the future dimensions of ships.

2. — Types of works for berthing ships of great draught in tidal seas.

1 p.m. Adjournment.

2.30 p.m. Resumption of discussion.

Evening

7.30 p.m. *Dinner given by the British Organising Committee to the Delegates and Members of the Association and Ladies attending the Congress.*

The Right Hon. Lord Desborough, K.C.V.O., presiding.

(Evening Dress. — Decorations.)

Wednesday, July 4th.

SECTIONAL MEETINGS

First Section, Inland Navigation. — Chairman :

Lord **Desborough,** K.C.V.O.

In Great Hall

10 a.m. Discussion of *Question N° 2* continued, *viz. :*

2. — Dispositions or arrangements to be adopted for locks, elevators, inclined planes, and other means of overcoming differences of level with a view to facilitating the operations.

12.45 p.m. Adjournment for luncheon (see below).

Second Section, Ocean Navigation. — Chairman :
Sir Ernest **Clover,** Bart.

In Lecture Theatre

10 a.m. Discussion of *Question N° 3, viz. :*

3. — The relative advantages of ship equipment and port equipment for loading and discharging ships. Mechanical equipment of ports, mechanical handling of freight. Loading, discharging and carrying between ships and the various depositing points, whether covered by sheds or not.

1 p.m. Adjournment for luncheon (see below).

12.45 p.m. *Afternoon :—Luncheons to Delegates and Members by the Corporation of Trinity House and the London Chamber of Commerce, and visit to Port of London Authority.*

Thursday, July 5th.

SECTIONAL MEETINGS

First Section, Inland Navigation. — Chairman :
Lord **Desborough,** K.C.V.O.

In Great Hall

10 a.m. Discussion of *Communication N° 1, viz. :*

1. — The influence of surface waters and subterranean sheets of water on the flow of rivers. Regime of mixed canals; estimation of the water consumed for navigation and irrigation uses; the portion returned to the subterranean sheet of water.

1 p.m. Adjournment.

2.30 p.m. Discussion of *Communication N° 2, viz. :*

2. — Unification of statistics of inland navigation with a view to facilitating the comparison of the results of the working of navigable waterways in various countries.

Second Section, Ocean Navigation. — Chairman :

Sir Ernest **Clover,** Bart.

In Lecture Theatre

10 a.m. Discussion of *Question N° 3* continued, *viz.* :

3. — The relative advantages of ship equipment and port equipment for loading and discharging ships. Mechanical equipment of ports, mechanical handling of freight. Loading, discharging and carrying between ships and the various depositing points, whether covered by sheds or not.

1 p.m. Adjournment.

2.30 p.m. Discussion of *Communications N^os 1 and 2, viz.* :

1. — Concrete and re-inforced concrete. Their applications to hydraulic works; means to insure their preservation and their watertightness.

2. — Use of liquid fuel for navigation and its consequences.

Afternoon :

4 p.m.-6 p.m. —*Reception by the Lord Mayor of London to all Delegates and Members (and Ladies) at the Mansion House.*

(*Morning Dress.*)

Friday, July 6th.

SECTIONAL MEETING

Ocean Navigation Section. — Chairman :

Sir Ernest **Clover,** Bart.

In Lecture Theatre

10.30 a.m. Discussion of *Communications N^os 3 and 4, viz.* :

3. — Utilisation of tides for the production of power for the working and lighting of ports and for maritime works (working of lock-gates, etc.).

4. — Principal advances made recently in lighting, beaconing and signalling of coasts. Standardisation (unification) of the languages of maritime signals.

1 p.m. Adjournment.

In Great Hall

The Right Hon. Lord **Desborough,** K.C.V.O., President.

2.30 p.m. General Meeting of the Congress to adopt and record resolutions on the various Questions and Communications of the Sections.

Close of the Discussions of the Congress.

Saturday, July 7th.

Visit of Delegates and Members (and Ladies) to Windsor Castle.

Sunday, July 8th.

Visit of Delegates and Members (and Ladies) to the River Thames and Taplow Court by kind invitation of The Right Hon. Lord Desborough, K.C.V.O., President.

Programme of Excursions to Works in the Provinces.

Monday, July 9th, Tuesday, July 10th and Wednesday, July 11th.

Monday 9th. — **Southampton Visit.**

Delegates and Members (and Ladies) visit the Docks, Southampton, by kind invitation of the Southern Railway Company (South Western Section).

Tuesday 10th. — **South Wales Visit.**

Delegates and Members (and Ladies) visit the docks of the Great Western Railway Company by kind invitation of the Railway Company.

Tuesday 10th. — **Manchester Visit.**

Delegates and Members (and Ladies) visit the Manchester Ship Canal by kind invitation of the Chairman and Directors of the Manchester Ship Canal Company.

Wednesday 11th. — **Bristol Visit.**

Delegates and Members (and Ladies) visit the Port and Docks at Bristol by kind invitation of the Docks Board, Bristol.

Wednesday 11th. — **Liverpool Visit.**

Delegates and Members (and Ladies) visit the Port of Liverpool by kind invitation of the Chairman and Directors of the Mersey Harbour Board.

Congress Ends.

GENERAL MEETINGS

AND

SECTIONAL MEETINGS

MINUTES

OF THE

FIRST GENERAL MEETING

(OPENING MEETING)

Monday 2 July 1923 (at noon)

The opening of the XIIIth International Congress of Navigation took place in the Great Hall of the Institution of Civil Engineers, Great George Street, Westminster, in London, S. W., 2nd July 1923, at midday, under the presidence of the Right Honourable Lord Desborough K.C.V.O., President of Congress.

His Majesty King George, High Protector of the Congress, had deigned to designate His Royal Highness to represent Him at the ceremony.

Exactly at noon, His Royal Highness entered the Hall and was conducted to the table of honour in the midst of prolonged cheers.

There sat down also at this table :

The Right Hon. Lord Desborough K.C.V.O., President of Congress; on the left of the President of Congress : MM. Helleputte, President of the Permanent International Association of Navigation Congresses; Mahieu, President of the French delegation; Sanjust di Teulada, President of the Italian delegation; Burlamaqui, delegate of Brazil; on the right of the President of Congress : MM. Gevaert, President of the Permanent International Association of Navigation Congresses; Sir Maurice Fitzmaurice, C.M.G., F.R.S., Deputy President of Congress; Dr. Maw, C. H., M. P., President of the Institution of Civil Engineers; Colonel J. C. Oakes, delegate of the United States; Wortman, delegate of Holland; Teisuke Harada, delegate of Japan.

Behind the table of honour were seated the official delegates of Foreign Governments, as well as the members of the Organizing Commission and the committees of Congress.

When the meeting was completely assembled, *The Right Honourable* **Lord Desborough** *opened the meeting.*

The President. — Your Excellencies, My Lords, Ladies and Gentlemen,

His Royal Highness the Duke of York has been good enough to come here to welcome you, and I will at once call upon him to do so. *(Cheers.)*

H. R. H. the Duke of York, K. G., K. T., who, on rising, was received with loud cheers, said : It is with much pleasure that I am here this morning to welcome you on behalf of His Majesty, who is a Patron of this Conference *(cheers)*, and who looks forward with interest to valuable results from your deliberations. The international character of this Conference makes it most important. The fact that the delegates from foreign countries and from our own Dominions, India, and the Colonies have come here from all parts of the world to meet together proves that a Conference of this sort is to the interest and advantage of every nation. Although the subjects to be discussed are largely of a technical nature, it is easy to realise that navigation, whether ocean or inland, is a factor which vitally concerns the country, because the exchange of goods of all kinds is, to a large extent, carried on on the sea.

Apart from the results of your labours, this Congress cannot fail to be of mutuel advantage to you all. In these difficult times any meetings which enable individuals of different countries to get to know one another and to understand one another must be of the greatest value to the world at large.

I heartily wish this Congress every success, and I trust that our guests from overseas may find time, amidst their labours, to enjoy their stay amongst us *(cheers)*. I can assure them that they are most welcome *(cheers)*.

I have now very much pleasure in declaring this Congress open. *(Loud cheers.)*

The President. — May it please your Royal Highness, My Lords, Ladies and Gentlemen : As the President of the Thirteenth International Navigation Congress, it falls to my lot very briefly, but very heartily, to express the thanks of this great gathering to His Royal Highness the Duke of York for coming amongst us on this occasion and for declaring the Conference open. (*Cheers.*)

I should like to thank him personally for having so readily acceded to my request, and to assure him that every delegate present, whether he comes from these Islands or from across the seas, feels it a compliment that he should have been welcomed to this Conference by His Royal Highness the Duke of York. *(Cheers).*

His Royal Highness is no stranger to the sea. He served with gallantry on the sea fighting for his country in the Great War *(cheers)*, and that makes us regret the more that his many engagements prevent him from assisting us to assimilate the five-and-a-half tons of papers which, I understand, have been distributed to the delegates of this Congress. (*Laughter*). On behalf of all of you, no less than on my own behalf, I thank His Royal Highness for his presence here to-day. (*Cheers.*)

M. Helleputte, President of the Permanent International Association of Navigation Congresses : My Lords and Gentlemen :

In the name of the members of this Congress, I also thank His Royal Highness, the Duke of York, for the great honour he has done us by assisting at this meeting. This mark of kindness touches us deeply and I beg His Royal Highness to accept this expression of our profound gratitude and our respectful devotion. *(Cheers.)*

(His Royal Highness the Duke of York then left.)

The President. — It is now my duty, as President of this Congress, to open the proceedings by a short Adress. I should like personally, on behalf of the British Organising Committee, to repeat to you all the cordial message of welcome to this country which has been delivered to you by His Royal Highness the Duke of York. We were very pleased that London was chosen as the centre in which the Congress of 1923 was to be held. A similar

Congress under the auspices of this Association of Navigation Congresses has not been held in this country for 33 years. Since the year 1890, Congresses have taken place in Paris (1892), The Hague (1894), Brussels (1898), Paris (1900), Dusseldorf (1902), Milan (1905), St Petersburg (1908) and at Philadelphia (in 1912) when President William Taft addressed the assembled delegates on a similar occasion to the present opening ceremony. It is also a great gratification to us, especially the British Organising Committee, that the invitation extended by the British Government to the Governments of the countries supporting the Permanent Association was accepted by so many foreign Governments and I cordially welcome the presence today of the distinguished gentlemen appointed by them as their representatives. *(Cheers.)*

We have with us today official representatives of twenty-six Foreign Governments, as well as the official representatives of the Governments of India, South Africa and the Irish Free State. We have also with us representatives of Canada, New Zealand, Russia, the League of Nations, the International Commission of the Danube, the European Commission of the Danube, the Rhine Commission and the Suez Canal Company. We have representatives appointed by the principal dock and harbour authorities, canal undertakings and shipping companies, as well as many distinguished engineers from various parts of the world — all interested in inland and maritime navigation.

It was with great regret that we heard some time ago of the death of M. Dufourny, one of the two Presidents of the Permanent Association. M. Dufourny was a most distinguished engineer who represented Belgium on the Suez Canal Commission, and he had for many years taken a very deep interest in the work of the Permanent Association and, indeed, in the promotion of this London Congress. He was personally known to many of us, and we all regret the loss of a distinguished colleague and a good friend.

I also wish, as President of the British Organising Committee, to mention here the loss which we have suffered by the deaths of three British writers of papers for this Congress. Mr. Walmisley, Engineer of the Dover Harbour Board; Mr. Adam Scott, a civil engineer in Westminster; and Mr. Carle Salter, the distin-

guished superintendent of the British Rainfall Organisation, who contributed a most valuable paper to our proceedings.

It is a great pleasure to me that so many delegates are attending this Congress. I most cordially welcome today M. Helleputte, Ministre d'Etat *(cheers)*, the President of the Permanent Association of Navigation Congresses and, on behalf of the British Organising Committee, I desire to thank him and M. Lambin, the General Secretary of the Permanent Association, for their help and advice in the work of organising this Congress.

I take the first opportunity of congratulating M. Gevaert, who has this morning been elected Joint-President with M. Helleputte in the place of the late M. Dufourny. I should also like to take this opportunity of expressing my very deep gratitude to the British Organising Committee, but more especially to the Honorary Secretary, M. Dunwoody *(cheers)*, who has been engaged most of his days, and I think all his nights during the past year in the work of organising this great Congress *(cheers)*. I also thank him for writing to me I think about twice a day for the last year and a half. *(Laughter and cheers.)*

We have here today representatives of all concerned with inland and maritime navigation. We have shipowners and shipbuilders and naval architects, chairmen of harbour boards and their engineers and managers; we have engineers — civil, mechanical and electrical — engaged in the design and construction of inland canal and maritime works. We have many others engaged in various forms of transportation. We are all met for purpose of promoting and advancing the progress of inland and maritime navigation. We propose to do that by considering valuable papers which have been prepared for us after much investigation and labour by some of the most competent experts from the various countries represented. As the late M. Dufourny once said:

« These congresses bring together engineers who in all parts of » the world have to carry out the work required to adapt the » canals, ports and rivers to the needs of the public. Everyone is benefitted by the knowledge, the studies and the experience » which his colleagues at the Congress have acquired. The ques- » tions are treated from broad, general and universal points of

» view. This union of efforts has brought about in a few years » great advances in the vast domain of hydraulic works. »

He went on to point out some of these advances. The discussions of the Vienna Congress in 1886 served as the basis for the investigation into the cross sections to be adopted for the whole of the canals of Central Europe. The transformation of the Erie canal for 2,000 ton boats was inspired by the ideas developed at that Congress. The construction of locks to overcome great differences of level and of lifts for boats were considerably advanced as a result of the same Congress. The question of the protection of the banks of canals and rivers has been thoroughly studied and presented in valuable papers. The experiments necessary to determine the shape of boats and the cross sections of canals so as to reduce the efforts of traction to a minimum were also carried out on the suggestion of previous Congresses. The Congresses have also been the means of bringing forth great developments and improvements in high-powered dredging appliances and in the machinery used for construction. M. Dufourny concluded his opinion upon the value of such Congresses in these words :

« It may indeed be said in general terms that in the course of » a few years the International Association of Navigation Con- » gresses has passed in review so well and so completely the » domain of hydraulics and navigation that there exist in this » domain a universal science and a doctrine which serve for the » whole world as the basis for modern technical teaching. Local » opinions and theories founded on narrow and circumscribed » data, have given place to a general science which the world-wide » contributions to the art of the civil engineer have done so much » to form. This science, the offspring of the Congresses of » Navigation, has done much in the past and it will bring forth » in the future still greater and more valuable results for the » benefit of mankind. »

Another Congress is now assembled. We must do our part in this great work. We must each of us do our part by adding what we can to this scientific knowledge.

I do not propose to say much at this stage about the different questions and communications which we are about to discuss. It is too much to expect that we can all eventually agree on all the

subjects put down for discussion. I am, however, sure that with so many experts present who are capable of dealing with all the phases of the different matters to be considered, that the discussions at this Congress will prove of the greatest possible value to everyone of us and that this London Congress of 1923 will bring forth as great and as valuable results as any previously held. Some of the questions which we are about to consider have been discussed at previous Congresses, but, because of their importance and the continual progress in navigation matters, they have been brought up again for consideration. In some cases the questions put down on our Programme may not have sufficiently ripened today to enable us to come to very definite conclusions. There are, however, no reasons why we should not review these subjects from time to time in the light of new experience. Our discussions will probably hasten the time when definite and final pronouncements may be made on many of them.

The British Organising Committee have been glad to arrange that you shall have opportunities of visiting different undertakings in Great Britain. Those of you who travel throughout this country will find that the natural features of the land do not lend themselves to the provision of those magnificent canals which you are accustomed to see upon the continent. Our rivers are small in comparison. We are less dependent upon inland navigation than many other countries. No part of our island is far distant from the sea. The sea is our great canal. We have, as you know, many important ports. We have endeavoured by private enterprise and, in many cases, under financial difficulties, to keep both our large ports and our small ones in an efficient state for dealing with modern ships.

Some of you will no doubt visit the Port of London where imports and exports of nearly every kind are dealt with. Others will visit Southampton in the south, where the largest Atlantic liners are provided for. A number will visit Bristol — one of the oldest ports, now extending to the docks at Avonmouth. Some no doubt will find their way to the important ports in South Wales, where the export of coal is so large a factor. In the North you are to pay a visit to the Port of Liverpool, and to the Manchester Ship Canal — the last great water engineering undertaking

of its kind carried out in this country since the railway era. The Manchester Ship Canal and the Port of Liverpool serve the most populous industrial district in England.

At all these places you will receive a most cordial welcome from the proprietors of the undertakings, who, at the invitation of our Organising Committee, have generously provided for your entertainment. At each of them I trust you will find much that is helpful and of interest to you, and I hope that, when you leave our shores, you will have the most pleasant recollections of the International Navigation Congress of 1923. *(Loud cheers.)*

M. Helleputte (President of the Association) :

Mr. Chairman, Ladies and Gentlemen,

The Permanent International Association of Navigation Congresses, in whose name I have the honour to speak, has, as it first duty, to pay a respectful tribute of gratitude to His Majesty King George V, who deigned to grant his high patronage to this memorable meeting, and thus attest the lively interest that he takes in the work of our Association. and all questions concerning navigation.

We must further thank Their Excellencies the Prime Minister, the Under Secretary of State for Foreign Affairs, His Majesty's Ambassador to France, the Secretary of State for War, the Chancellor of the Exchequer, the Speaker, the President of the Board of Trade, the First Lord of the Admiralty, the Minister of Health, the Minister of Transport and the numerous other British personalities who have been good enough to place their influence and their authority at the services of the XIIIth Congress. The Local Organising Committee in London has also the right to our thanks and our commendation. It has admirably prepared the sittings of the Congress. To it will belong the merit and honour of the success which is in view.

The President, the Right Honourable Lord Desborough, the Deputy President, Sir Maurice Fitzmaurice; the Chairman of the Ocean Section, Sir Ernest Glover; the General Secretary, Mr. Dunwoody, and their devoted assistants, will have their names inscribed in our annals amongst the most eminent collaborators of our Asso-

ciation. And how could I forget the writers of papers, who at the price of arduous labour, have supplied the numerous and learned papers submitted for our deliberations. It is by reason of them that the London Congress will mark, with its place in our history, new advances in the art of engineering. The Congress has a considerable task to fulfil.

I shall not enumerate the questions which figure in the programme — they are known to you all. It is the first Congress that we hold since the great War. Today we link up again the chain of our traditions interrupted by the gigantic conflict which caused entire Europe to totter. We feel a special pleasure in being able to do so in the capital of the British Empire, which occupies so great a place in the maritime world. Great Britain is above all a shipping country. Its geographical situation, the extent of its coasts, its numerous roads and superb ports, its powerful Dominions and rich Colonies ensure for it a priviliged part in the traffic of the world. For a long time our members have desired to hold their sittings there. Now their wish is realised.

They will allow me to remember my own country for a moment, and to recall to mind that it was at Brussels, five and twenty years ago, that birth was given to the idea of rendering the organisation of our Congresses permanent. I am particularly happy to be able to celebrate this anniversary in the capital of Great Britain, with whom we have for centuries entertained and preserved the most amicable relations. With the noble Allies, who are all represented here, she generously aided us to defend our violated soil, to push back the invader, to remain a free people in an independent nation.

The mission of our Association is essentially a work of peace. When opening the session of 1898, I recalled this phase which serves us as a device : « To live is not a necessity, but to nagivate is one. » How much more evident does this necessity appear after the trial which the world has undergone, breaking or loosening the ties which bound nations together, the maintenance of which is, however, one of the conditions for the progress of humanity. It is for the progress of humanity that it is our duty to work. This duty we have the will to accomplish. I express

the sincere wish that our work may be useful to all the nations represented on our Association, but above all to Great Britain.

Certain of being the faithful interpreter of our sentiments, I renew, in terminating, the expression of our gratitude towards the great country which has received us with such generous cordiality and I say in the name of you all :

Long live King George the Fifth, Emperor of India !

Hurrah for Great Britain ! Hurrah for the City of London. !

(Loud cheers.)

The President. — I now call upon Dr. Maw, the President of the Institution of Civil Engineers, to whom we owe our deep gratitude for the handsome provision which has been made for our meetings in this magnificent building. *(Cheers.)*

Dr. W. H. Maw, LL. D. President of the Institution of Civil Engineers. — Mr. Chairman, Ladies and Gentlemen : It is now my privilege to extend to you a most hearty welcome to the Institution of Civil Engineers. The Congress you are about to hold, attended as it is by many men of the highest distinction in their several professions, will have under its notice a number of questions of the greatest national importance, and these questions are, I am glad to say, all more or less intimately associated with the work of engineers. It is thus quite right that the Council and members of the Institution, on whose behalf I am speaking, should welcome you heartily to their building, and should do all they possibly can to assure carrying out your programme to a success. This being so I need only say that I desire to assure you, firstly, that you are most heartily welcome here; secondly, that you have our most earnest wishes for the complete success of your deliberations; and, lastly, we hope when your work is ended here and you leave us, you will carry back with you some pleasant memories of your visit to the Institution of Civil Engineers. *(Cheers.)*

The President. — I should like to inform the Congress that we have received the following telegram :

« Warsaw,

» To the President of Navigation Congress,
» Great George Street, London.

» I have the honour to address my greetings to the Congress and » the representatives of all the nautical sciences of numerous » nations, both in the name of the Department of Public Works » and that of the Polish Engineers. Receive also my heartiest » wishes for the full success of your undertaking.

» Minister **Dr Lopuszanski.** »

(Cheers.)

Colonel J. C. Oakes (United States of America). — Mr. President, Ladies and Gentlemen : As the substitute of Colonel Sanford, who for many years has been associated with this Organisation, I cannot hope to take his place; but I desire, on behalf of my country, to express our sincere appreciation for your very courteous invitation and to assure you of our interest in the proceedings of the Conference. Our country is a large one; our problems are very great; and we look forward with very great interest indeed to the discussions on the papers that are to be presented. I desire to thank you once again for your courtesy, and to say that I am sure we shall have a very happy and interesting time, not only from a professional but other points of view. *(Cheers.)*

Mr. Mahieu (in French). — Ladies, Mr. President, Gentlemen : I am very happy to be called upon to thank you on behalf of France, all of you, Gentlemen, who have organized the XIIIth Congress of Navigation and I congratulate you on the great success which is announced.

Thanks to His Majesty King George, who has kindly favoured our meetings by giving them his high patronage, and thanks to the British Government which has given us such a hearty welcome. Thanks also to the Local Organising Commission which did not fear to accept the task of presiding over the work of this Congress,

the first after a long interval. Finally thanks to the Council of our Association, to its eminent President and to our General Secretary, who have thought to reunite us in the city of London in order to study the problems of navigation. We could not in fact make a better choice than the capital of noble and valiant England.

We are the hosts of a sea-faring people, navigators, for whom the prosperity of navigation is of national interest. We have only to see what is done here to be able to obtain useful instruction and that is why I am glad to see the XIIIth Congress held in the capital of the British Empire.

I am also pleased to see us assembled at the Institute of the English civil engineers, because these engineers have known how to show everywhere their science and spirit of realisation. Thanks to them, many difficulties have been overcome, nearly everywhere in the world in matters of navigation. No example could be better, and we shall need only to be inspired with their traditions and their work, in order that the conclusions of the XIIIth Congress cause the science of navigation to make progress.

Navigation, Gentlemen, has taken on a vital importance for many countries, and several of these countries which formerly took no interest in navigation, have been induced by the force of events, to recognise that it was one of the essential factors of their prosperity and that it could not be separated from the other means of transport by land or rail.

The Congress of Navigation, that is to say the meetings such as to-day, cannot but facilitate both the development of navigation and the connection between the other means of transport. It is by meeting one another that the men of all the countries learn to know and estime one another, and all here are animated with the same desire of peace and union.

Our Association of Navigation as our colleagues the Roads Association and the Railway Association : all three have only one object : to make progress in science for the greater benefit of our respective countries, and as our President has just remarked, for the greater benefit of humanity.

France is proud of associating herself with this work of peace. It is with all her heart she thanks those who have united us for the prosperity of all.

I am sure that the XIIIth Congress will be worthy of its predecessors and that it will mark a date in the history of our Association. *(Applause.)*

M. Sanjust di Teulada (in French). — Mr. President, Ladies and Gentlemen : I have the honour, as first Italian delegate, to thank you on behalf of my Government for the kind invitation to this imposing Congress, which promises to surpass all those which have preceded it.

Italy which was the cradle of inland navigation with the network of canals of Lombardy, of which the most ancient dates from the XIIth century, has lately desired by the creation of the new grand canal from the Po to the Lagoon of Venice to demonstrate, that it is not content to be a museum, but that it intends to be the head of modern progress in Inland Navigation as in Ocean Navigation.

It is then with enthusiasm that we take part in this superb and learned meeting which will have the effect of drawing still closer, if possible, the bonds of friendship which unite us.

You will permit me, Mr. President, to give my respectful homage to His Majesty the King of England, Emperor of India. Italy has not forgotten, nor will never forget, the visit which His Majesty the King as well as Her Majesty the Queen kindly made to our Sovereigns and our country. The old friendship which unites our two countries has shown itself once again immovable; you will permitt me to wish that it may be perpetual. (*Applause.*)

M. H. Wortman (Holland). — Mr. Chairman, Ladies and Gentlemen : Like all nations which are represented here, Holland is glad that the International Navigation Congresses have once more resumed their periodical gatherings, after an interval of eleven years. Bounded as it is by the sea on two sides, and situated at the mouth of the Rhine, the most important of Europe's inland waterways, the very vital interests of our country are connected with navigation. For many centuries our sea-going ships have been seen on the most remote seas and at the same time our river ships sailed up the Rhine and other inland waterways to the centre of Europe. So navigation has largely contributed to the

prosperity of our country. On the other hand, when navigation on the North Sea was almost entirely stopped during the late war, Holland suffered severely, and felt most painfully the truth of this device of our International Association : « Navigare Necesse ». And so it will be clear to all that Holland is happy that the sea is free once more to navigation. We are now improving our harbours and our rivers and canals to make them fit for the requirements of future navigation. And in this task we hope to profit by the discussions which will be held here on technical and economical questions connected with navigation and by the examples the British engineers will show us in harbour-building and harbour practice. We are especially glad that we have come together now in this country, which, like our own, owes its greatness and prosperity to the sea, and to which we have been bound by friendly relations for many centuries.

I hope that our gatherings under the guidance of you, Mr. President, and of the prominent British engineers who will preside over the sections of this Congress, may contribute in a large way to the development of engineering science and navigation and to the benefit of our countries. *(Cheers.)*

Senhor F. C. Burlamaqui (Brazil). — My Lord President, My Lords and Gentlemen : I have heard with great attention and particular interest the eloquent words that your Excellency has pronounced. A member, since eleven years, of the International Permanent Association of Navigation Congress, I have the honour to be present for the first time as delegate for Brazil (together with Admiral Jose Maria Penido, delegate of the Brazilian Admiralty) at this thirteenth Congress which is now opening under the auspices of your Excellency's Presidency. This commission is for me a great honour, as it gives me an opportunity to take part in such a select meeting composed of the most eminent engineers and professionals of the countries here represented, and also I feel to a certain extent a responsibility in the fact that I am replacing on this occasion the notable Brazilian engineer Souza Bandeira, who died in 1920, and who — while alive — rendered great services to my country, as well as to the Association that organises this Congress. The decisions that have

resulted through the deliberations of previous Congresses organised by the Association since 1888 with so much profit, give an excellent basis for the resolutions that are to be taken in questions of navigation, and are of great value to countries possessing maritime and fluvial communications; therefore, they are of primary interest to Brazil owing to the immense extent of coast and the fluvial network that she possesses.

Brazil is a country essentially maritime, having its future well-being directly connected with the continuation of the construction of her harbours, for which very large amounts of money have already been spent, and being also particularly interested in regard to the expansion of her mercantile navy. In consequence of all these facts, any questions or communications that may be discussed at this Congress are of great interest to my country, as the conclusions we may arrive at will be a guide for Brazil in the execution of projects not yet commenced, and also for those that my Government will have to elaborate in the near future, through the medium of the Inspectoria Federal de Portos, Rios e Canaes, Inspectoria Federal de Navegacao e Costas of the Ministry of Public Works. *(Cheers.)*

Mr. T. Harada (Japan). — Your Excellencies, My Lords, Ladies and Gentlemen : As the representative of Japan, I have the honour and pleasure to say a few words on this occasion. I believe that it is a matter for congratulation that experts from so many different parts of the world should be assembled here in this famous maritime country for the accomplishment of work which can only be beneficial to the nations of the world. With the highest respect I thank His Majesty the King for the patronage which He has graciously extended to this Congress and we are gratefully appreciative of the fact that the Opening Session has been honoured by the presence of H. R. H. the Duke of York. May I add that we also owe a debt of gratitude to all those permanent and temporary officials to whose strenuous labours we are indebted in a large measure for the successful inauguration of our Congress. In conclusion I desire to express our heartiest greetings to Great Britain who is extending her hospitality in so cordial a manner to the members of this Congress. *(Cheers.)*

The Meeting then terminated.

MINUTES OF THE MEETINGS

BUREAU OF THE FIRST SECTION

(Inland Navigation)

President.

GREAT BRITAIN

Rt Hon. Lord **Desborough**, K.C.V.O., London.

Vice-Presidents.

BELGIUM

M. **Richald**, Ingénieur en Chef, Directeur des Ponts et Chaussées, Professeur à l'Université de Gand, Membre de la Commission Internationale Consultative des Travaux du Canal Maritime de Suez, Secrétaire Général honoraire de l'Association Internationale Permanente des Congrès de Navigation, Bruxelles.

SPAIN

Don **Javier de Salas.**

UNITED STATES

Colonel John C. **Oakes**, Corps of Engineers U. S. Army.

FRANCE

M. **Armand**, Inspecteur Général des Ponts et Chaussées, Paris.

M. Désiré **Bourgeois**, Ingénieur en Chef des Ponts et Chaussées, Paris.

GREAT BRITAIN

Mr. J. R. **Brooke**, C.B., Secretary of the Ministry of Transport.

Sir John **Eaglesome**, K.C.M.G., M.Inst.C.E., Managing Director of the Aire and Calder Navigation, Leeds.

ITALY

M. Raimondo **Rava,** ancien Président du Magistrato alle Acque, Venise.

HOLLAND

Jhr. C. J. A. **Reigersman,** Ingénieur en Chef, Directeur du Waterstaat de la Province Noordholland.

SWEDEN

M. **Lubeck**, Député, Gouverneur de la Province de Gavleborg, Membre de l'Académie Royale des Sciences Techniques, Stockholm.

M. **Ekwall,** Capitaine au Corps Royal des Ponts et Chaussées, Directeur des Travaux de Construction de l'Administration Royale des Forces Hydrauliques et des Canaux, Membre de l'Académie Royale des Sciences Techniques, Stockholm.

Secretaries

BELGIUM

M. H. **Descans**, Ingénieur Principal des Ponts et Chaussées, Chef du Bureau de la Batellerie à la Commission des Réparations, Paris.

SPAIN

Don Narciso **Puig de la Bellacassa,** Ingénieur en chef des Routes, Canaux et Ports, Madrid.

FRANCE

M. **Partridge**, Ingénieur des Ponts et Chaussées, Port de la Bourdonnais, Paris.

M. **Antoine**, Ingénieur des Ponts et Chaussées (Service de la Navigation Strasbourg-Bas Rhin), Strasbourg.

GREAT BRITAIN

Mr. G. J. **Griffiths,** M.Inst.C.E., Engineer of the Thames Conservancy.

Lieut.-Colonel F. **Rayner**, D.S.O., M.Inst.C.E., Engineer of the Trent Navigation.

Mr. Verner **Macassey,** A.M.Inst.C.E., Assistant Secretary.

ITALY

M. Frederic **Tornielli de Crestvolant**, Ingénieur du Génie Civil.

HOLLAND

M. G. J. **Van den Broeck,** Ingénieur en Chef du Waterstraat, Amsterdam.

SWEDEN

M. **Lawski**, Lieutenant au Corps Royal des Ponts et Chaussées, Ingénieur au Bureau de Construction des Canaux à l'Administration Royale des Forces Hydrauliques et des Canaux, Stockholm.

M. **Eneborg**, Docteur ès Sciences, Rédacteur en Chef du Journal de l'Administration Royale de Commerce, Stockholm.

FIRST SECTION

(Inland Navigation)

FIRST MEETING

Monday, July 2nd, 1923 (afternoon)

The Rt. Hon. Lord DESBOROUGH K.C.V.O., in the chair.

The Meeting was called to order at 2.30 p. m.

The Chairman. — Gentlemen : I do not propose to take up your time at any length, but merely to open the Congress with a few remarks which are usual on this sort of occasion.

The subjects which are before this section of the Congress for discussion are four in number, namely :

(1) The utilization of waterways for the production of power; its consequences and applications;

(2) Dispositions or arrangements to be adopted for locks, elevators, inclined planes, and other means of overcoming differences of level with a view to facilitating the operations;

(3) The influence of surface waters and subterrean sheets of water on the flow of rivers. Regime of mixed canals; estimation of water consumed for navigation and irrigation uses; the portion returned to the subterranean sheet of water;

(4) Unification of statistics of inland navigation with a view to facilitating the comparison of the results of the working of navigable waterways in various countries.

The very valuable reports on these subjects, which have been contributed by distinguished engineers from nearly all the parts of the world, provide a fund of information which is the result of their research and experience. In every way they go to show the very great advance which has been made in all directions, and every engineer whose works are in any way connected with waterways will undoubtedly find it most useful to have these records in his library for future reference. I may repeat what I said this morning : that I have been informed by many distinguished engineers that they have found the papers which have been contributed to these Congresses of the greatest possible use to them, when they have been preparing schemes of various sorts connected with navigation and waterworks generally.

Dealing first with the subject of the *utilisation of waterways for the production of power*, it is perfectly obvious that this is one of the most important subjects for investigation by engineers. The visible supplies, at all events, of both coal and oil for motive power are limited, but the rain which falls from heaven and the tides which are drawn by the moon are with us, and I suppose will be with us always. Therefore there is in the future a very great field for the engineer in which to turn himself to those elements to provide the motive power of the future.

In dealing with waterways, especially inland waterways, there are perhaps four very important aspects in which they affect the public vitally, especially in regard to the Thames. There is the question of the water supply to the inhabitants of the country; there is the question of navigation on these rivers; there is the question of water power to be provided for the turning of wheels, which is one of the first objects of civilisation, and there is also the question of irrigation. There is no doubt that in the future we shall have to adapt our rivers to supply all these four wants, and it is equally certain that engineers will have to come together and will have to work these four objects in unison one with the other. I happen to have been Chairman of the Thames Conservancy Board for something like 18 years. The Thames is the biggest river in England. I do not pretend it is a big one; but it is the biggest we have got. Two years ago we were menaced by a water famine. The River Thames supplies the greater part

of the drinking water for a population almost as big as that of Canada. Seven millions of people drink the water of the Thames. The Thames is also used for power, though not nearly as much as it used to be. There are mills up and down the Thames. It is also used for transportation and for pleasure. In 1921, on more than one day the inhabitants of London drank the whole of the Thames, and the consequence of that was, as it was done rather without warning, that the navigation was stopped; there was not enough water on the lower docks sills. It shows how important it is that all these services of the inland waters should be co-ordinated through the efforts of engineers.

Then as regards the development of power, we here cannot expect for one moment to develop much power from the fresh water that we have got. Anybody who has been to Niagara knows how insignificant water power in this country is. I remember being at Niagara many years ago and meeting the great engineer Tessler, who said that if he was given Niagara, he could dominate the world. We have got nothing of that sort here at all; but when you come to the matter of tides, of course it is rather different.

The next subject which we have to consider is that of elevators, of getting barges from one level to another. Most interesting papers have been written on this subject, and it is one which I myself have rather near at heart, because I invented or inspired a mechanical elevator which is in use at Boulter's Lock on the Thames. I hope that the engineers here will take the opportunity, when they come down to Taplow on Sunday, of going and seeing this contrivance. It is like a continuous electrical staircase. You put your boat on, and you are taken from one level to the other. It has proved a very great success as people can sit in their boats while they are taken from one level to another. I have no doubt that the principle, which was very cleverly worked out by the engineer to the Thames Conservancy Board, Mr. Griffiths, could be adapted for barges and flat bottom craft. You have only to make the wheels stronger and the whole concern on a larger scale, and I think you would be able to do it. The difficulty we found was, in order not to break the boats, to keep the 18 feet of bearing which you want for small boats always on the straight.

Our conveyor has always 18 feet of flat bearing, even when it goes over the apex. It is rather interesting, and I propose to have a model of it on view here for engineers to see, and I hope when you come down on Sunday, you will be able to see the actual machine in operation. It uses no water, and we have found it very useful, especially in the year of the drought which was 1921.

We shall hear, I hope, a great deal about canals. I trust we shall hear about them from gentlemen who come from the continent and from across the Atlantic. We all know there are vast schemes in Canada and in the United States, and also we know the splendid transport, and how it is used, on the Rhine and on the Danube. There are important representatives of those great works and of those great schemes attending this Congress, and I shall certainly hope to hear from them.

The last question is that of comparative statistics. I am sure if they could be got out on some universal system, all those who are interested in waterways, water-power, or water generally would find them of the greatest assistance to them in their work.

I should now like to take the opportunity of thanking on your behalf as well as my own all those who have contributed these very interesting papers which are before this Congress, and also the General Reporters. They have gone through the papers with the very greatest possible care.

I propose that we should open this discussion by the report of the General Reporter on Question n° 1. That would be Sir John Purser Griffith, to whom we are indebted for this ceiling amongst other things. Sir John is an ex-President of the Institution of Civil Engineers. We want to have an interesting discussion on all these points, not at great length, but sticking very closely to the point. I have no doubt that finally we shall be able to reach some decision on the resolution which will be submitted to the Congress on the report of the General Reporter. Perhaps we shall not, but perhaps we may.

I look forward with the greatest possible interest to the discussions of this section on the very important matters which have been submitted to it.

I now call upon the General Reporter, Sir John Purser Griffith

to give us a resume of the conclusions at which he has arrived on Question n° 1.

« **The utilisation of waterways for the production of power; its consequences and applications.** »

This question has been dealt with by Colonel William Kelly (U. S. A.), Messrs. Armand (France), Binnie, Meik, Twinberrow, Addenbrooke and Hindmarsh (Great Britain), Palluchini (Italy), Lübeck and Ekwall (Sweden), Smetana, Pacak and Till (Czechoslovakia).

Sir John Griffith reads his general report and the conclusions he submits for consideration by the Congress, viz. :

1) *That in view of the shortage of fuel, and its increasing cost, it is necessary to develop water power wherever available.*

2) *That this Congress, while primarily interested in problems associated with Inland Navigation, recognises the importance of combining navigable waterways with water power installations.*

3. *That by such a combination cheap power is obtained, cheap industries are fostered, and cheap transport is provided, and that charges on capital are more easily met.*

4. *That where possible the various interests in domestic water supply, navigation, water power, and fisheries should be co-ordinated, and works designed to combine and safeguard such interests.*

5. *That in dealing with these problems no universal rule can be laid down, but that each case must be considered and treated on its merits.*

6. *That for this reason it is desirable to have State control of the Water Resources of the country ; and to establish an Authority to allocate water for the various interests; with a Service whose duty it should be to investigate proposed schemes, and formulate a policy for utilizing in the best interests of the community the Water Resources of the country.*

7. *That in regard to the utilization of the tides for power purposes, the recommendations of the Water Power Resources Committees of Great Britain and Ireland are worthy of support, and that communications be invited on the subject for consideration at a future meeting of the International Navigation Congress.*

M. Richald (in French). — Mr. President and Gentlemen.

May I be permitted first of all to congratulate the Reporters for such interesting considerations inserted in their papers, and especially to M. Armand, Inspector General des Ponts et Chaussées.

Sir John Purser Griffith is also entitled to our congratulations, for the analysis of the reports is very well presented, and the conclusions proposed for examination by the Congress ought to be admitted, in condensing them if possible, under reserve of the two following observations relating to the 2nd and 3rd of the said conclusions.

On the subject of the 2nd. I should like to see the principle of the establishment of weirs with a high fall of water explicitly affirmed on the canalised rivers as far as the configuration favours this, this point of view having been ignored at a time when coal was inexpensive.

Certain countries have been working in this direction and it is praiseworthy that the Congress supports them with its authority.

In what concerns the 7th, I consider that the 1st Section which attends to inland navigation cannot deal with the utilization of tides for the production of power, for the 2nd Section (Maritime Section) has inscribed this question on its programme as the examination of the subjects submitted at this moment to its deliberations plainly shows.

Mr. Sidney Preston. — My Lord and Gentlemen.

There are probably so many engineers present who are qualified to speak on the question of power development that I do not propose to say anything about that subject at all ; but I do want to say a word with reference to the question of damming up rivers in order to obtain that power. The primary « raison d'être » of a river is drainage. I do not notice in any one of the papers which have been presented any reference whatever to the effect upon drainage or damming up the rivers. The damming up of rivers primarily helps navigation; it gives a good depth of water in the reaches above the dam, and reduces the velocity. Therefore the construction of dams for producing power and helping navi-

gation naturally go hand in hand, but the damming up of a river is really quite antagonistic to drainage. The drainages of this country have suffered a good deal in the past by concessions having been given to flour mills, and some other interests, years ago. This may not matter in the very large rivers of America, Canada and the Continent, but it is a serious handicap in the smaller rivers of this country. I happen to be one of the Commissioners for the Ouse Drainage Board. We are very severely handicapped in the Ouse in regard to the question of drainage by rights having been given to individuals in the past to construct dams in order to head up the water for flour mills, and also by rights having been given to head up the water for navigation. As a matter of fact, on the Ouse the navigation rights of the upper river are in the hands of an individual. I do not know how they got into his hands, nor does it matter; but for some reason, although he owns the rights, he will not allow any navigation to go on, and it is a fact that the mitre gates on the Ouse are nailed together by cleats in order to prevent any possibility of their being used. The consequence is that the drainage is very much hampered, and I for one have been constantly urging the Commissioners for the Ouse to endeavour to buy out that right. Whether they will ever do so is another matter.

All I want to say is that it is all very well to dam up rivers in order to get power, but that was not the primary object of rivers, which were formed for carrying off drainage. Sir John Griffith has just briefly referred to the matter on page 9 of his paper where he says that the Irish Commissioners stated :

« We are of opinion that the true solution of the problems which » have been submitted to us in regard to Irish waterways depends » on the reconciliation of these interests. We are satisfied that » these interests — especially, as we have stated, those of drainage » and navigation — are capable of being reconciled by the use of » modern engineering methods. »

All I can say is that it may be possible, but it has not yet been done.

I had occasion, on behalf of the Ministry of Agriculture, to inspect the river Stour in Suffolk, and there I saw many cases of falls where rights had been given that had been derelict for over

20 years — in some cases 25 years. Although the mill power was not used, still the river was dammed up, and nobody seemed to have the power to get that damming up cleared away and the river opened to let the floods off.

The question is also lightly referred to by M. Armand in his paper, on page 16, where he says :

« The weir-dams should be as completely water-tight as pos-
» sible, water losses reducing the quantity of available power,
» especially at low water periods. They should be easily, rapidly
» and surely worked, because the water will always be retained at
» the greatest height permitted by the situation, and it must be
» possible to maintain it the longest possible time, only opening
» the weir at the last moment when the flood arrives. »

That is just the very point. When the flood arrives the land above the weir becomes flooded.

I am afraid that my remarks are rather more destructive than constructive, but I do think my point is one worthy of consideration by those engineers who are only anxious to pound up water in order to get power. It may be a very laudable idea, but the primary object of a river is drainage, and I do not think that ought to be lost sight of.

Those are all the remarks I have to make, and I should not have made them had the point been referred to ; but I do think it is a point which ought to be fully borne in mind.

Col. John Arthur Saner. — My Lord and Gentlemen,

Before I say what I had proposed to state when I rose, I might be allowed to refer to the closing remarks of the last speaker. (Mr. Sydney Preston). Of course it is important that the navigation rights, the drainage rights, and any other rights, should be preserved. On the River Weaver, for which I have been engineer for many years, those questions are not in the first two instances—that is to say, water is provided for navigation, and the drainage of the land is provided for—by sluices constructed on what is known as the Stoney principle, as modified by Mr. L. B. Wells, sometime Engineer to the Weaver Trustees. The weirs on the River Weaver are by these means entirely removable in

time of flood, and can be regulated so that the water is let off either gradually or very rapidly, and so obviates flooding the land. That is all I would say on that point for the moment.

It seems to me that the greatest difficulty to be overcome in using the English rivers for power purpose is that of storing the surplus electricity produced during flood time so as to make it available in time of drought. The River Weaver (which perhaps I may remind you runs through the centre of Cheshire, and is altogether some 50 miles long, with a very large tributary, the River Dane, which comes down from the Derbyshire hills) during the highest floods has been known to deliver about 24,000,000 cubic yards of water in the 24 hours; that is to say, 1,000,000 cubic yards of water an hour. The minimum flow may be taken at something less than 50,000 cubic yards an hour, and during the minimum flow all the water is required for navigation purposes. Something like 1,250,000 tons per annum is carried when traffic is good, and as the traffic must have precedence it is only for limited periods that surplus water is available for other purposes. It is practically impossible, therefore, to regulate the water and the power obtained from the water so as to have a continuous supply for both purposes.

As far back as 1896 or 1897, I went into the question of driving electric motors by means of turbines supplied from the river, but I found then that unless the turbines were supplemented by either steam or other power there could be nothing like a continuous supply, even for the small amount, viz.: 200 H.P., which was suggested.

I was not satisfied, and further investigated the subject about two years ago, but came to the same conclusion, that in order to maintain sufficient water, more especially during the summer months, for navigation purposes, auxiliary steam plant must be provided. That, of course, means double capital expenditure, and very largely detracts from the saving which is presumably to be obtained by the use of water. If you come to take into consideration a fact which I have often been almost laughed at for putting forward, namely, that our coal and petrol supplies are not inexhaustible, then it may be policy to go to further expense in order

to obtain water power, but I do not think even then you will find that much power can be obtained from the rivers and canals of England (of course, I am not referring to the Thames, which the Chairman mentioned, or the Severn), but I should be very sorry to see that day arrive in this country because I feel certain that if we ever did come to that point our industries would fall off to such an extent that we would not require any more coal or anything else; we should have to close up.

I do not know that I can say any more. I thought it was a point I might mention, that we had been somewhat of pioneers in attempting to use the water of the River Weaver as early as 1896, and had then found (and afterwards confirmed) it was really not worth putting down the capital expenditure that was necessary for the complicated plant required to prevent any delay to the navigation or any interference with the agricultural drainage.

M. Müller (in French). — I regret very much having received the ordinary reports too late, that is to say, this morning, I could not then study them and I must confine myself to what the General Reporter has said. I have read with interest the report of Sir John P. Griffith and I must remark, that as to the conflicts between the different interests on the waterways that not only in the United States, but elsewhere for example in our country the concessions granted were sometimes insecure. It is a well known fact, and very old also, that the obstacles to a more extensive development of the utilization of power on the waterways, were not only the question of former legislation, which moreover in different countries, were already being reformed, interrupted unfortunately by the war, but it was also on the other and not less the ignorance of technical conditions in which the conciliation of the various interests would be able to be realized. It is true it is not possible to lay down a general rule on this subject, but there can be indicated in my opinion at least certain necessary conditions to be fulfilled in order to be able to think seriously of the utilization of power on waterways.

In examining this question two categories of waterways must be distinguished : free flowing rivers and canals. For what concerns the first, the interests of navigation are completely safe-

guarded if the necessary flow is left in the bed in order that 1) the depth be sufficient for navigation and 2) the current of water remains strong enough to prevent the formation of deposits of sand and gravel.

For the canals the admissible limit of velocity which would not hinder navigation must be examined.

This velocity is determined by the following conditions : *a*) the resistance which acts against the boat going up-stream muts not exceed the practical value admitted for economical towing ; *b)* the current must not exceed the measure corresponding to the resistance and solidity of the soil and the banks of the canal in order to keep it in safe condition.

These conditions can only be determied with sufficient security by means of trials on the navigable waterways themselves.

I believe it useful to take this consideration into account because I have seen in different reports that there are very few practical experiments on this point, and that it would be very useful to continue them, in order to be able to determine as far as possible, the practical limits and conditions of the utilization of power on waterways .

It is in this order of ideas, that I would wish to see completed the conclusions of the report of Sir John P. Griffith.

In what concerns the 7th. of these conclusions, I agree with Mr. Richald that its object enters rather into the attributions of the Maritime Section.

Mr. R. B. Dunwoody, O. B. E. — My Lord and Gentlemen, It was not my intention to speak on this subject until I came into the room a few moments ago, as I have been extremely busy in connection with the other arrangements for this Congress. This subject, however, has always been one of very great interest to me. For many years past the question of the proper allocation of the water supplies of this country has received attention at the hands of Committees and Royal Commissions. Some fourteen years ago, I carried out special investigations into the supplies available for improved canal routes. I hope, therefore, I may offer some observations.

I assume that I am in order in speaking to number 6 of the resolutions of Sir John Griffith. In that resolution he urges « That for this reason » — that is, that « where possible, the various interests in domestic water supply, navigation, water power, and fisheries should be coordinated » — « it is desirable to have State control of the water resources of the country, and to establish an Authority to allocate water for various interests ». It is on that aspect of the subject that I wish to say a few words.

The Royal Commission on Canals, which sat some 15 years ago, had the task of investigating whether or not it was possible to improve the canals of this country. For that purpose it was necessary to investigate whether or not there were sufficient water supplies to enable large canals to be provided. On investigating that question, as to the water supplies available, it was found that there was practically no information — at least very little which was of use—regarding the water resources available in different districts. There are no records kept, except by one or two authorities, such as the Thames Conservancy Board, of the river flows of this country. As a consequence there is a very great scarcity of information as to the available flows of rivers in different areas and on different kinds of geological formation. In addition to this absence of data, there are all these complications to which you, my Lord, and other speakers have referred, of ownerships and rights, which give rise to great difficulties when you come to deal with the allocation or the further use of particular water supplies. This recommendation of Sir John Griffith has been supported by Royal Commissions in the past. From the investigations which I conducted for the Royal Commission on Canals, I came to the conclusion long ago that a complete control of the water resources of this country must be undertaken by some central body if these water resources are to be put to the best use.

On the conclusion of the Royal Commission's investigations, I submitted a scheme to Mr. John Burns, who was then the President of our LocalGovernment Board, suggesting the carrying out of a complete survey of the water resources of the country, and for the keeping of complete records.

The Water Power Resources Committee of the Board of Trade also strongly recommended action on the same lines. I consider

that, at any rate in this country, and I think in most countries where water is required for public supplies or for inland navigation to any large extent, it is essential that there should be a central control of these supplies, so that the quantities which are available may be utilised in the most economic and efficient way.

I am extremely obliged to you, my Lord, for allowing me to make these disjointed remarks. I am very glad to have been accorded an opportunity of addressing this Section of the Congress.

Mr. Griffiths (Engineer to the Thames Conservancy Board). — My Lord and Gentlemen,

Having regard to Mr. Preston's remarks I felt that I should like to tell you of my experience of the river Thames. The Thames is primarily a navigation river, but on it have been situated a number of mills. Its gradient, for a start, is very flat, and I am afraid that is the case with other rivers throughout the whole of the country, with the exception of Scotland and Wales. The fall is only 1 ft. 10 in. per mile, and experience goes to show that the utilisation of that water for power purposes is out of harmony with navigation, and also out of harmony with the regulation of drainage. I see no difficulty myself in utilising a river for the three purposes of navigation, drainage and power, provided that the control of all those three is in the hands of one authority. On rivers such as you have in Canada and in Europe, I myself feel that the greatest possible use ought to be made out of them for water power. We are coming to a shortage of coal and oil fuel, and we are bound to make such investigations as we can with a view to utilising that power to its best possible purpose, as also must eventually be done with tidal energy.

With regard to the damming up of a river, I do not myself find by experience that it does interfere with the proper drainage of the land, provided that you efficiently control your weirs, and utilise them as they should be used.

My experience with regard to power purposes on a flat gradient river is very much that of Col. Saner's, that the expenditure is not warranted in this country.

With regard to the question of water supplies, the Thames, as our Chairman has already told you, is largely the main source for London. In 1921 we experienced a drought such as we had not experienced before in history, but personally I see no reason why we should not have a worse one, and it is up to the powers that be to co-ordinate all these different interests with a view to allocating the water supply to its best possible use in order to provide for circumstances such as have arisen as late as 1921.

Naturally these waterways could in many cases be better utilised for power purposes if sufficient reservoir storage could be provided, but the expenditure is not warranted as I see it at present. I feel, myself, that we have got to take in hand the proper allocation of the water resources of the country so that one town does not rob another, and so forth. That has been the experience on the Thames.

The Thames Conservancy, as an impartial body, has had to step in and oppose the taking of Thames water for the use of towns outside the watershed.

I do not know that I have very much more to say. I only felt that you would like to know that, with a river such as the Thames, its use as a source of water power is almost a dead letter. There were some 20 odd mills on it about 20 years ago, but those that have fallen into disuse, have not been rebuilt again.

M. Armand (in French). — Gentlemen,

I request permission to speak in French, because I am not acquainted with the English language.

I do not think it necessary to take up again here the general discussion.

As I pointed out on page 12 of the french text of my report, it is very difficult to give a solution of the principle for the mixed arrangement of a water course. After having discussed in a general manner the different kinds which may be of practical use, I have stated what I knew of the installations now being constructed or under consideration.

A question certainly interesting and which has not been sufficiently discussed, is that of the velocity that can be admitted on routes which are used at the same time for navigation and power.

Certain reporters seem to want to limit this velocity too much for the great section canals, by means of which great power can be realized.

I am going now to examine quickly the conclusions which are proposed by the general reporter.

The first of these does not raise any difficulty, but I believe an amendment should be made to the text. It is worded there « considering the shortage of fuel and its increasing cost ». This expression in french appears to mean « in order to establish the shortage and the increasing cost of fuel ». I think therefore a slight alteration should be made in the text with respect to the form not changing however the idea of the author.

The second. For the second of these conclusions, I should propose the following text which seems to express the very idea of the general reporter.: « The present Congress while being chiefly interested with Inland Navigation recognises the importance of combining the conditions of navigableness of waterways with installations of power production ».

Irrigation and drainage have been spoken of : it seems to me that these considerations which are not in the question laid before the Congress might be left aside here.

That does not mean that they are without interest, but to meet these requirements does not generally require an important alteration of the works necessary for navigation and power. On the Rhine for instance it is merely considered that the irrigation water will be either derived from inlet canals to the factories, or pumped by using the electric power produced.

For the third of these conclusions, the terms appear too general. « By such a combination, cheap power is obtained, cheap industries are fostered, and cheap transport is provided, and that charges on capital are more easily met. » It is not always the case. The works must generally serve in common to several interests ; and in this case the expense borne by each of the parties interested will be reduced.

It is in this sense that the conclusions must be worded : The mutual employment of these works would often facilitate the establishment of economical transport routes.

The fourth of the conclusions is a part of the third : it is the repetition of this assertion that the utilization of certain works for several uses is often economical ; and if it was desired to condense the conclusions, it would perhaps be necessary to combine the 4th with the 2nd and 3rd.

The fifth is not doubtful.

The sixth of the conclusions states « that it is desirable to have State control of the water resources of the country ». There are countries where this control exists.

It would be better to say : « It would be desirable to have State control of the water resources of the countries where this control does not exist ».

As regards the seventh, I entirely agree with M. Richald ; it is a question which pertains to the 2nd Section, as it concerns tides.

The Chairman. — As there appear to be no more speakers at the present moment, I think it would be as well if I put the conclusions which have been brought before the Congress by Sir John Griffith.

The first conclusion is as follows :

« That in view of the shortage of fuel and its increasing cost, it is necessary to develop water power wherever available ».

That means where it can be done economically, I suppose.

M. Richald (in French). — It is very difficult to word forthwith conclusions which relate to the observations which have been made. Consequently I propose that the Committee of the Section form a technical sub-commission, entrusted with the drawing up of definite conclusions. In this fashion, a text thoroughly studied could be submitted to the meeting to-morrow.

This procedure is moreover that which has always been followed in former Congresses.

If Mr. President agrees to this proposal, he will kindly design the members of this sub-commission. The General Reporter, Mr. Griffiths and M. Armand, who has just formulated various amendments to the original conclusions of Sir Griffith, seem to be most fitted to make part of this sub-commission.

M. Müller (in French). — I quite agree with the observations put forward by M. Armand. In what concerns the proposal to form a sub-commission entrusted with drawing up definite conclusions, I am entirely of M. Richald's opinion, because I consider it is not possible to prepare a new text forthwith.

M. Armand (in French). — I propose that M. Antoine, Secretary of the French Section who knows English perfectly should also be a member of the sub-commission.

Mr. Barrington. — Would you permit me to say a few words as one who has attended a good many of these Congresses ? I quite sympathise with the views that have been put forward by the last speakers, the French gentlemen and others. I came here to learn, and not to express any views of my own. I know that in most of these Congresses no formal resolution has been arrived at. I think it would be very much more desirable that the Congress should not subject itself to any particular views.

The Chairman. — The only reason why I put the first conclusion of the general report was in order to get ahead. Personally I think there are too many of these conclusions. It has now been proposed that there should be a committee to draw up a general resolution which should be submitted to the meeting to-morrow. I think that is a very good idea. I hope the Committee will be able to bring up to-morrow a shorter resolution founded on the general report.

M. Fontaine (in French). — Since de end of the war, interest is beginning to be taken in water power. Coal has become a factor of exportation improving the rate of exchange and efforts are being made to economise it. The river Meuse from Seraing to Visé passing by Liége, constitutes the most favourable application of a great river suitable for inland navigation and power.

This organisation can be carried out very avantageously below Dutch Limburg thanks to the Belgian equipment upstream. A second application would be the new grand section canal to be constructed between Lixhe on the Meuse opposite the Dutch-Belgian

frontier on the right bank and Antwerp in passing by the new coal basin of Limburg.

The result of the two applications which I have made is the use of water sections of 310 square meters on the diversion of power Meuse-Lixhe, of 150 square meters on the Lixhe-Sutendael canal, of 200 square meters on other branches. Consequently I support most heartily the request of M. Müller, Delegate of Czechoslovakia that experiments be made on the velocity of the current of water admissible for navigation. To my knowledge, the most favourable canal constructed in the interest of power production is below Olten (Switzerland).

The inlet canal was begun in the summer of 1914, the factory in 1915. Working began the 27th november 1917 already, and gave immediately interesting financial results : 6 then 7 %. The production of power in 1919-1920 was. . . . . 178.320.000 Kwh.

The proceeds from sale of power	4.101.000 frs.
Interest of shares (11.800.000 frs. paid). .	826.000 frs.
Interest from bonds (20.000.000)	1.234.000 frs.

In 1919 the first system developed 267 kilometers.

A part of the current was sent to Belfort, Epinal and Nancy. Now, this enterprise, purely electrical remunerating up to now by itself alone the capital invested comprises an inlet canal (branching from the Aar) 6200 meters long and able to discharge 350 cubic meters a second (maximum velocity of current : 1 m. 40). As the sections (used according to the nature of the ground) comprise more than 6 meters of anchorage and widths of platform from 24, 26, 32 to 40 meters, it can be seen what importance to navigation this enterprise would be.

The only disputable point in the use of a power canal for navigation is the greatest admissible velocity of water.

The Olten canal would permit many instructive experiments on this point with respect to canals of 150 to more than 300 meters of mooring section.

Mr. Beckett — then proceeded to give a detailed account of a project for building a weir acros the River Stern, when,

The Chairman interrupting, said : I should like to remind the speaker that it is not the practice of this Congress to allow the reading of a long paper. If the speaker desired to send in a paper he should have written it and sent it in. It would then have been included in the general mass of papers and been submitted to the General Reporter. The whole object of the Congress would be defeated if the people who wrote the really official papers could not read them, but anybody could get up and read a very long paper of his own. That is not the lines on which this Congress is organised. You ought to have printed your paper and sent it into the report. In these meetings you must limit yourself to short remarks of a more general character.

Mr. Beckett, continuing said : One general remark I would like to make is that the advantages of a dam placed below the Severn Tunnel are very considerable. I have estimate the cost of such a dam—just the civil engineering constructional cost, exclusive of any turbines and generating plant—at about £3.500.000 including the lock. The point I want to make is this: it might be worthwile to construct a dam, without going into the question of the tidal power, for the benefit it would give, first of all by providing a road across the estuary, secondly by providing foundations for a railway across the estuary, and thirdly for the docking facilities which would be given by the damming up of the water. The water would be held up at least 20 ft higher than it is at present at low water spring tide, permanently, and could be kept higher still by not using so much for power purposes. The more water you use for power purposes, the lower your dock low water becomes. The point I should like to try to make is that it would be an advantage, without going into the question of providing a storage reservoir or other means of getting over the difficulty of carrying the power all through the day, to construct the dam, and then expirement is necessary with various turbines and other plant to find the best means of utilising the power afterwards.

Mr. Addenbrooke said a question had been raised as to the position of the barrage in the report presented by Messrs Meik, Twinberrow and Addenbrooke on the utilization of the Severn Estuary.

He would point out that the selection of Beachley was at present only provisional though the arguments generally pointed to it as the most favourable site. In putting forward this site they had to arrive at a compromise on the vital question of cost and power, and the best means of reconciling existing interests. The lower a barrage is placed down an estuary the larger the quantity of water which can usually be impounded and consequently the greater amount of power. As a matter of fact it is only necessary to go far enough down the Severn Estuary to obtain probably the largest hydroelectric installation in the world. But that is not practical, at any rate at the present time. By adopting a site near the Severn Tunnel the amount of power available would be increased some 25 % over that obtainable at Beachley, and they had carefully considered the neighbourhood of the Severn Tunnel in 1917, as an alternative site, but there were any arguments against it.

It was a difficult site geographically, and physically ; also it was desirable to do nothing in any way likely to be detrimental to that very expensive undertaking, the Severn Tunnel. Therefore, they had provisionally given the Beachley site the preference when in 1918 they placed the matter before the Water Power Resources Committee.

At Beachley they had good foundations, a narrower crossing, less depth of water and a slower current than at the Severn Tunnel. If, however, no resolution was to be put before this section bearing on the question of utilization of tidal power under such conditions as he had referred to, he would suggest that further discussion on their paper should be transferred to N^r 3. Communication where it appeared that other similar papers were to be dealt with on Friday next.

The Chairman. — There being no more speakers inscribed we shall leave to the sub-commission of which the General Reporter, Mr. Griffiths, M. Armand and M. Antoine will be members the duty of drawing up conclusions which are inspired by the observations presented during this meeting. These conclusions will be submitted to the Section during the meeting to-morrow morning.

The meeting closed at 5.30 p. M.

FIRST SECTION

(Inland Navigation)

SEGOND MEETING

Tuesday, July 3rd, 1923 (morning)

The Right Hon. Lord DESBOROUGH, K.C.V.O., in the chair.

The meeting was called to order at 10 a. m.

The Chairman. — When we left off last night I had the name of one other delegate who wished to address the Congress on the main question, and I will therefore very soon call upon him. In the meantime, we are very much indebted to the sub-committee which sat after the meeting yesterday to go through the resolutions which will be submitted to you this morning. There was some slight discrepancy of an important character between the French translation and the English original. This has been amended, and also the original resolutions have been somewhat curtailed, and made perhaps a little more in consequence. They will shortly be submitted to you.

I will now ask M. du Bousquet to continue the discussion.

M. du Bousquet (in French). — Allow me in a few words, to call the attention of the Congress to certain considerations not all together connected with the present debate, but which appear likely to be taken into account in certain cases, to fix the direction of the economical study of the problem laid before us.

I have been impressed with the scepticism which various speakers have shown in regard to the utilization of falls of average power

and variable discharge and the interest taken by certain reporters relative to the integral regulation of flows even at the price of costly works.

In my opinion the question would be frequently simplified if the use of power realizable by the development of canals and rivers was considered as a simple element of the general problem of electrification.

Especially, when the power to be recovered is found to be relatively feeble considering the needs of the districts, the small or medium hydro-electric power stations could connect with the great distributing systems and divert at each instant their available power thus realizing the maximum economy of fuel.

This it seems, must be the case, for instance, for the Seine valley already supplied with electric power by many great electric stations (including the Genevilliers Station the most powerful in the world) an which is going to receive in addition water power from the Central plain and later on from the Rhone and the Rhine. The quantity of power likely to be produced by the falls of the Basse Seine will form in this whole only a relatively trifling fraction, and in our opinion their use must be studied from this point of view.

In a more general manner considerable efforts are at present being made under the impulse of the Minister of Public Works and thanks to the initiative of private industries to realize the interconnection of the power stations and systems, and also the general equal distribution of the available power of the country.

Such conditions seem likely to be met with in other regions.

That is why, without dwelling on electrical technics, it appeared to us interesting to point out to the Congress the connection of the two questions the utilization of power susceptible of being produced by streams and general electrification.

The Chairman. — We are very much indebted to the last speaker for his most interesting remarks.

Unless there is anyone else who wants to address the meeting on the original question, I think we might now proceed to consider the conclusions which are now being submitted through the medium

of the Committee. We are very grateful to the Committee for the trouble they have taken in drafting these resolutions.

The **first resolution** is :

« *That in view of the shortage of fuel and its increasing cost,* » *it is necessary to develop water-power wherever available.* »

The resolution was put and carried unanimously.

The Chairman. — The **next resolution** is :

« *That this Congress, while primarily interested in problems* » *associated with navigation, recognises the desirability of the* » *establishment, when possible, of works both useful to navigation* » *and power purposes.* »

The resolution was put and carried unanimously.

The Chairman. — The **third resolution** is :

« *That whereas no universal rule can be laid down and each* » *case must be considered and treated on its merits, it is desirable* » *to take into consideration, if possible, the requirements of all* » *other interests affected such as : protection against floods, irri-* » *gation, domestic water supply and fisheries* »

The resolution was put and carried unanimously.

The Chairman. — The **fourth resolution** is :

« *That for this reason it is desirable that the water resources* » *of a country should be under the control of one authority, whose* » *duty should be to guide the utilization of those resources in the* » *best interests of the community.* »

This resolution was put and carried unanimously.

The Chairman. — The **fifth resolution** is :

« *All technical research work likely to throw light on the deci-* » *sions which this Authority will be called upon to take is to be* » *encouraged, especially if tests can be carried out on canals hav-* » *ing dimensions corresponding to modern boats.* »

The resolution was put and carried unanimously.

The Chairman. — That concludes the paper and the discussion on the first question. We have now to consider whether we shall go on to the second question, or whether we shall adjourn until this afternoon. I think on the whole perhaps it would be as well to adjourn. I am sorry to say that I shall not be able myself to be here this afternoon, especially as I am very much interested in the question which is coming before you, namely, mechanical means for raising boats from one level to another. I hope when you come down to Taplow on Sunday you will see a little mechanical contrivance which I think is rather ingenious, and which, I believe is unique of its sort, by which boats are, without the slightest trouble, raised from one level to the other by an electric boat conveyor on the principle of a revolving staircase. It has proved on the Thames of the very greatest possible advantage. When the river is very crowded on Sundays and other days, we have raised in one week, chiefly on one day, 1.500 boats, and the electric current as supplied by the Municipality came to the magnificent sum of six shillings and eight pence. Therefore, as far as the motive power is concerned, it is fairly cheap. I hope engineers, when they see it, will consider whether the system cannot be so developed as to carry flat bottom and large barges without using any water. In 1921, when we were very short of water, we closed the lock. We wanted to impound the water so as to let it down when it was required for the Metropolitan Water Board, and we used this mechanical boat conveyor almost entirely. A model of it is outside.

The question is whether it would not be better now to adjourn till this afternoon.

A Delegate. — Might I suggest that the Reporter's paper be read this morning. It would give an opportunity to the delegates to think out what they wish to say this afternoon.

M. Müller (in French). — I suggest that before the conclusions on any other question are voted upon, they should be distributed before-hand.

The Chairman. — We will try to arrange that. The suggestion has been made that the report on the second question should be

read this morning. I think it would be better to adjourn. However we might read the conclusions of the reporter on the second question. They are as follows :

First, that locks are still the best method of overcoming differences of level in a navigation channel especially where the difference of level is not excessive and the water supply is ample.

Second, that where the difference of level in a short horizontal distance is great, especially if the water supply is deficient, lifts and inclines will probably be more economical and save much time in the passage of the heavy traffic.

Third, that the choice of a lift or an incline will depend on the configuration of the ground and the size of the boats. If the slope of the ground is very steep and the weight to be lifted does not exceed 100 tons, a vertical lift is probably best.

Fourth, except for small pleasure craft, such as ply on the Thames, no satisfactory method has yet been introduced practically for transporting loaded cargo boats by land.

Fifth, that rapidity of entering and leaving locks is greatly facilitated by : (a) *a judicious location of the lock, or lift, in reference to the alignment of the canal;* (b) *the provision of suitably placed and ample lie-bys at both entrances;* (c) *ample sluice ways in the lock chambers walls with small passages from them to the lock chamber to avoid the disturbance of the water caused by sluices in the lock gates;* (d) *ample dimensions of the lock chamber with reference to the size of boat in use;* (e) *a good lighting for passing traffic at night.*

We have found on the Thames that one of the most important things is to separate the big boats from the little ones. It is the little boats that get in the way of the much easier navigated mechanically propelled boats which go straight through. One little boat will stop a whole Boulter's Lock for some time. We now have the boats separated into two channels. The little boats go one way and the big boats go the other, and we get them through about ten times as quickly. At Boulter's Lock it used to take 6 hours to get through the lock on Sundays before we made the conveyor. Now they get over the mechanical conveyor in one and a half minute.

The sixth conclusion is : *The success of power driven capstans at locks is one over which there is great difference of opinion, some authors advocating them strongly while others do not consider them suitable or necessary, as all boats must have motive power of some sort with them.*

Seventh, M. Denil's method of reducing the velocity of the water in reaches in which it is excessive is advocate in several of the Communications and seems to the Congress to merit consideration.

We will meet at 2.30 this afternoon to consider these papers and to hear them criticised and discussed.

The Meeting adjourned at 11. a. m.

FIRST SECTION

(Inland Navigation)

THIRD MEETING

Tuesday, July 3rd, 1923 (afternoon)

Sir Maurice FITZMAURICE, C.M.G., F.R.S., in the chair.

The meeting was called to order at 2.30 p.m.

The Chairman. — Gentlemen, we have to examine to-day the second question, viz.

« **Dispositions or arrangements to be adopted for locks, elevators, inclined planes, and other means of overcoming differences of level with a view to facilitate the operations.** »

This question has been dealt with by Messrs Van Wetter and Schoentjes (Belgium), Edward H. Schulz (U. S. A.), Deval and Tumerelle (France), Cruttwell, Saner and Griffiths (Great Britain) Gasparini (Italy), Wentholt (Holland), Vinberg and Lawski (Sweden), Klir (Czechoslovakia).

I beg Mr. **Sidney Preston,** General Reporter, to resume his report and read the text of his conclusions.

Mr. Sidney Preston gives a short account of his general report and reads the text of his conclusions.

M. Richald (in French). — Mr. President and Gentlemen, I wish to communicate to the meeting following reflections and observations.

Examining the conclusions proposed by the General Reporter, I think it would be sufficient to connect them with those formulated

by the IXth and Xth Congresses by completing the latter, but however making various important modifications.

First of all, I consider that it would be very useful to recall the interest which we take in this matter, namely, that the extensive application of an inclined plane be realized, given the numerous conceptions which were presented a few years ago at the Vienna competition.

As regards the elevators, the Milan Congress of 1905 pointed out that the vertical elevators constitute a solution which experience has approved. On this subject, there is occasion to remark that since then, the vertical elevators on floats have not given complete satisfaction with respect to their working.

I allude to the Henrichenburg elevator.

On the other hand we have seen another conception brought out : the rotative elevator of Niederfinow for 600 ton boats.

It results that the wording of this point relating to elevators, should be modified.

As to the 100 ton load fixed as the limit for elevators, by the General Reporter in his conclusion, there is occasion to recall that two hydraulic elevators with two communicating lock chambers were constructed in Canada at Petersborough and at Kirfield for 800 ton boats in 1894 and 1907.

In the present situation, the progress of industry is such that I do not think I am exagerating, when I say that elevators of the latter type could be built to assure the passage of boats 1.000 to 1.200 tons, indeed even 1.500 tons.

Finally, I wish to call your attention to what follows concerning 6°) which points out, without concluding, the different opinions concerning the use of mechanically operated capstans. Capstans of this kind if well operated are very useful in my opinion. Indeed we must not forget that there are still a fairly large number of boats, especially of 300 tons, which have no power on board.

Capstans are called upon to render great service and their use should be recommended.

Such are the considerations which I submit to the attention of the Members of the Congress.

M. Bourgeois (In French). — Mr. President, Gentlemen.

I do not propose to make a detailed examination of the conclusions : I simply wish to make a few remarks.

There is a first question to be settled, it is that of ascertaining the conclusions answer directly enough and precisely enough the question submitted, namely :

« The dispositions or arrangements to be adopted for locks » and elevators, the inclined planes and other means of over- » coming differences of level with a view to facilitating the » operations. »

It is then this question that should be answered.

If the first four points of the conclusions presented are taken, it will be remarked that these four points do not specially concern the question submitted. If we go back to what was done in the Congresses of Dusseldorf and Milan which studied the comparison of locks with elevators and other means of overcoming differences of level we shall remark that the conclusions were nearly identical with the first four points cited above.

This was said at Dusseldorf : 1°) « The locks are still the sim- » plest and the strongest machine to enable boats to pass through » the falls of the canals provided with storage basins and allow » to reduce the consumption of water. »

« 2°) In the case of exceptionnal differences of level, to be over- » come on a short stretch, lock ladders are employed the opera- » tion of which is very practicable and is sufficient well known. » If the feed-water resources are lacking, the vertical elevators » constitute the best solution.

» 3°) The inclined planes applied up-to-now for boats have been » made the object of propositions by Engineers as regards their » application for large ships. »

If I took the conclusions of the Milan Congress, you would see that it is still the same thing. Consequently during the organization of the present Congress, the text of the question submitted was discussed with the representatives of the different countries. The Permanent Commission knew however that the question had been discussed in the two preceeding Congresses.

I demand that one states precisely the dispositions to be preco-

nized, as much for the locks as for the elevators, with a view to facilitating the operations for each of these works.

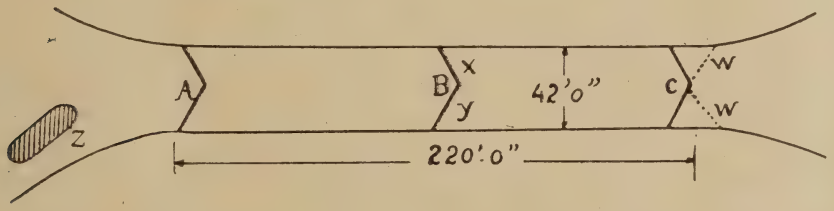
It is no more a question of comparing the use in principle : it is a question of arranging the approaches and also the works so that the passage of the boats may be rendered as easy and as rapid as possible.

I think we are unanimous that there is no occasion to return to the first four points.

I propose to complete these four points by a question of a concrete order which will come up in another Congress.

For the rest of the conclusions it is only a question of wording. For the present, I shall only deal with this question of principle.

Mr. J. A. Saner. — I should like to mention a matter of detail in connection with one of the conclusions, and that is the question of the protection of the lock gates from danger by vessels entering the lock. I take it that that is a part of the « dispositions or arrangements ». It was suggested in one of the papers that a wire rope or chain stretched across the lock would be sufficient protection to the gates but I should like to explain that that is not only the protection required, but protection is also required when the vessel is entering the lock from the lower waters In August 1914, I had a very exciting time, which I will describe by means of a sketch on the board :



The sketch represents one of the locks on the River Weaver. The width of the lock is 42 ft. ; the total length is about 220 ft. and it is divided by a pair of middle gates. When the vessel was coming up the river the gates « A » were open. The vessel ran into the lock and unmitred the gate « x » ; immediately the other gate « y » lost its support and collapsed into the lock. The

upper gates, as the rush of water took place, came together and were broken over. The same thing happened to the bottom gates. In the meantime the vessel had been shot stern first out of the lock and was lying at « Z ». It costed a great deal of money to restore the gates.

After the accident I suggested we should have wire ropes from the lock wall to the gate head, as at « W ». These wire ropes as the gate opens slacken downwards into the lock and are out of the way. Should the gate become unmitred in the future it is hoped the wire rope will hold the head of the fellow gate up.

Experiments shew that the rope does assist in preventing the unsupported gate from collapsing. If there is only a chain or a wire across the lock it does not provide for both ends, that is to say, it does not provide for a vessel coming up the river as well as going down the river. I think perhaps that explains what the reporter mentioned in the report.

I should like in the next place to call attention to the remarks by M. Richald with regard to lifts. I have had charge of the lift of Anderton for the last 35 years ; it is still working, being now entirely operated by electric power. The hydraulic rams were not a success after the first ten or fifteen years. A great amount of electrolitic action took place in them and they eventually had to be abandoned. In the alteration that I made I hung the caisson entirely by wire ropes from overhead girders, and it now lifts 250 tons through about 50 feet by means of electric power at a cost of one Board of Trade unit per operation. The time saved between passing the boats through that lift and their passing through the equivalent number of locks on another portion of the canal is in the ratio of ten minutes to 2 1/2 hours. I have advocated the extended use of that arrangement for a long time. It is one for which provision can be made in any new canals or any new arrangment of the old canals.

Wherever it is possible either inclined planes or vertical lifts should be adopted. There is no reason why, in my opinion at any rate, these electrically operated lifts should not be made for vessels up to 300 tons, if not more. In my arrangement it merely means adding more ropes to meet the increased length of caisson.

The only other point I wish to refer to relates to capstans. I think it is quite obvious that where the majority of vessels are dumb barges, i.e., barges without any power, it may be convenient at times to have capstans at the lock sides. It necessitates, however, a very large increase in the amount of machinery, and those of you who have had anything to do with maintenance will agree with me that the less machinery you have to maintain on the lock side the better because the wear and tear is so considerable

M. Wentholt. — Mr. Chairman and Gentlemen.

As you will know there is perhaps no country in the world which has a larger and more extensive experience about inland navigation than Holland. It is more than five hunderd years that the inland navigation is by far the most important way to transport goods from one part of our country to the other. It is because of this fact that perhaps the experience gained in Holland will interest you.

The first thing I think that must be mentioned is that in Holland there is a larger number of people who are capable boatman for inland navigation. The father of a skipper was skipper and it is probable that the son will be skipper too. The skipper's family lives on the barge and the father teaches the art of navigating on the rivers and canals to his son.

I mention this fact because this is perhaps the reason why in Holland with its many locks we have never felt the necessity for protecting lock gates from injury by boats running into them with disastrous results. As far as Is know there has been only one instance of injury of lock gates by a vessel, and in this case the vessel was a small man of war, of which the crew had no experience in navigating inland waterways.

I think it is an interesting feature that where the boatmen are capable, protecting works of the kind I mentioned are not necessary.

Mr. Cruttwell says that side-ponds are much in use in England where water supply is scarce, and he refers to the fact that water can be pumped back from a lower to a higher reach, but that this is expensive.

In Holland we have built no side-ponds for more than hundred years, for the reason, mentioned by Mr. Cruttwell, that because of the side-ponds emptying and filling the lock costs much more time, and because the construction of side-ponds is expensive.

In Holland we prefer to pump back the water. In some cases we do this with a special pumping plant, in other cases, where is locked into and out of a polder, indirectly by means of the pumping plant of the polder.

A very important question is the form of the entrance of a lock, and after my opinion it must be born in mind that during the time a vessel is entering a lock, a large amount of water has to leave the lock. By this water the handling of the vessel is largely hindered. Provision is to be made that the water can leave the lock even in the event of a vessel entering the lock in a skew way. Therefore I think it suitable to give the timber stockades a bended form in a way that the vessels are not turning around a point of the lock wall, but around a point outside of the lock. By this arrangement the water can flow along both sides of the vessel.

I am quite of the opinion of Colonel Saner that as the boat must have its means of haulage with it, it is not quite obvious why it can not be used in the locks.

In Holland the large locks at Ymuiden and the large locks at Terneuzen have been provided with capstans, but these are never used. At the locks of the important canals for inland navigation from Hansweert to Wemeldingen making part of the waterway from Antwerp to the river Rhine, and the canal from Amsterdam to the river Rhine, there are no capstans and the Engineers in charge of these canals told me that they had never been missed.

Only on canals with many sailing-boats, they would — after my opinion — be at their place.

The last large lock which has been constructed in Holland is the lock in the canal from the river Meuse to the river Waal, of which I gave a detailed description in « The Engineer » of 8th and 15th Sept. 1922. This lock has a useful length of 860 feet, a maximum fall of about 14 feet, while the width is about 52 feet. The lock is filled and emptied in 5 minutes. I mention this, because

of the fact that we think in Holland that it is of great importance that locks can be filled and emptied, and the gates can be open, in a short time.

The gates are operated electrically. I think that in Holland, where there are many electrically operated gates, the experience of the use of electric power is very encouraging.

The control for working the various parts of this lock are concentrated in one cabin above the upper gates of the lock. This cabin forms part of vertical lift-bridge by which a road is taken over the lock.

In the last years in Holland, locks where the higher reach is always at the same side of the locks have been provided with mitred gates, the locks where at the higher reach is at one moment at one side, at the other moment at the other side, — these are generally locks which give access from a river to a canal, and locks near the sea — have been provided or are being provided with caissons of the rolling type.

In this case one caisson can take the place of four mitred gates, in the other case of only two mitred gates. This is the reason why at the Meuse-Waal canal in one case caissons are less expensive, in the other case more expensive than mitred gates.

Because of what I mentioned I would suggest to make two alterations in the fifth conclusion :

1st-*b*) « The provision of suitably placed and ample lie-bys at » both entrances *and the provision of suitable approaches to the* » *lock.* »

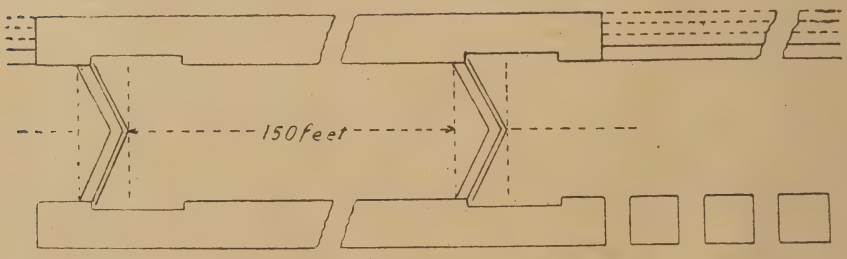
I think that it is necessary to add these last words to this conclusion because of the fact that suitable approaches are of no less importance than the form of the lie-bys.

2nd-*d*) I think it is necessary to add to the words : « *ample* » *dimensions* » the words « *and a judicious form* » so that this conclusions reads :

« d. *Ample dimensions and judicious form of the lock chamber with reference to the size of boat in use.* »

Colonel J. C. Oakes. — There are many points in this paper that I had intended to speak about, but I will confine myself

to a few remarks relating to the conclusions. It seems to me that the General Reporter and perhaps the writers of the papers, in drawing their conclusions, have not sufficiently discriminated between the difference in the sizes of the canals and the difference between locks in canals and locks in canalized rivers. Some of these conclusions, in my opinion, would not be satisfactory to the Engineers of the United States and they would not be considered as applying to our conditions because the latter are somewhat different from those that were in the minds of the people who wrote the papers and who formed the conclusions. For instance, we have in the United States very few small canals and locks now in operations However we have some small canals, in Louisana for instance, and a few locks on canalised rivers that are still operated for small traffic. What we call a small lock is one about 36 ft. wide by 150 ft. or 200 ft. long and 6 ft. depth on sills. As a general policy we now provide, where it is possible to give it, a depth of 12 ft. for the operation of barges of 1.000 tons and upwards Some of the barges that use such waterways are actually of 2.000 tons, and we find that a draft less than 10 ft., except in peculiar cases, is generally not economical under our local conditions. There are exceptions; for instance, the Ohio River, which does an immense coal traffic, using barges of 1.000 tons, has nine feet depth on the lock sills. The coal is shifted in fleets of barges. As many as 65.000 tons of coal have moved down the Ohio River in one fleet with one tow boat. The barges pass through the big locks in the Ohio River in squads of nine, ten and twelve with a tow boat.



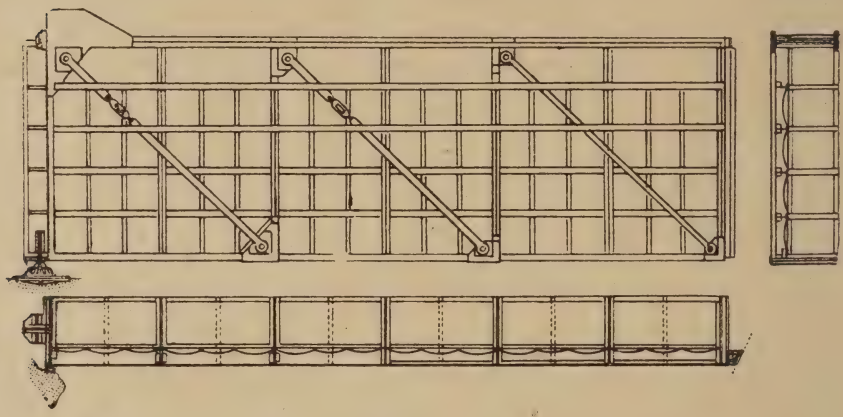
Sketch shows the arrangement of our lock approaches. We extend the guide walls at least as long above and below the lock

as the length of the lock and our guard wall is generally an interrupted wall with spaces, so that the boat comes in and moves straight into the lock, and the water ahead of the boat goes out through the spaces in the guard walls. That makes it very simple. Furthermore, we have practically no barges hauled by horses, mules or hand power; they are either hauled by tugs or self-propelled by machinery in the barges. Consequently we do not use capstans. I know of only one place in which we have provided any other means than the power on the boat or in the tug boat, and that is at the lock at Louisville, where I built a lock 600 ft. long, 110 ft. wide, with a possible lift of 39 ft. in order to pass coal boats and other traffic. At that lock I arranged for an electric locomotive, but it has never been used. They use the tug that tows the coal barges to move the barges in and out, sometimes with a smaller auxiliary tug to operate at the other end. They pass the barges through in fleets of nine and twelve at a time. The big tug pushes them in and the little tug moves them out, and no trouble is experienced. With reference to chains at the head of the locks, that matter has been considered very carefully by our Engineers particularly with reference to the Panama Canal, where General Hodges, who designed the locks, provided chains to stop the advance of the ship, but he also provided electric tractors to move the ships in the lock. I know of no other place in my country where we have used chains to stop the movement of the ship or the barge. We stop the barges before they enter; and so far as I know we have had no accidents to lock gates in the United States recently. At the lock at Louisville, I did provide at the upper gate a different type of gate. The consideration of impact was in my mind and caused the adoption of the gate; in other words, I adopted a vertical-framed gate with a very heavy horizontal girder which is capable of resisting considerable impact.

A heavy horizontal top girder, with verticals, supports the sheeting; and this heavy girder has a very heavy locking device at the junction so that when the leaves of the mitre come together this locking device locks and causes the mitred gates to come together exactly in the proper position. That heavy top girder with its locking device is considered sufficient to withstand any

impact that it may receive from the operations of the movement of the barges into and out of the lock.

I wish in particular to call attention to the second conclusion, which I think should be modified to say something about the size of the boats used in the traffic, if you are going to draw any such general conclusion; and the same remark applies to the third



conclusion. I refer to the second conclusion : « that where the difference of level in a short horizontal distance is great, especially if the water supply is deficient, lifts or inclines will probably be more economical and save much time in the passage of the heavy traffic ». I think that should be limited to saying « lifts or inclined will probably be more economical for small barges ».

The Chairman. — I do not think you need worry very much about the first, second, third and fourth conclusions, because, as has already been pointed out by one of the previous speakers, those conclusions do not really come under the heading of the question at all.

Colonel Oakes. — I did not know that you had accepted that suggestion.

The Chairman. — I think I shall have to rule that that is the case. The question is « Dispositions or arrangements to be adopted for locks, elevators, inclined planes, and other means

of overcoming differences of level with a view to facilitating the operations. » We have not as far as I can see to go into the relative advantages of locks and lifts, a question which I believe was settled pretty conclusively at the former Congresses. It is a very interesting subject, but I do not think it is our business to discuss it to-day.

Colonel Oakes. — Very well, Sir, I accept your ruling.

The Chairman. — You have something to say on the fifth conclusion, have not you ?

Colonel Oakes. — Yes. I should like to say something with reference to 5 (a) : « A judicious location of the locks, or lift, in reference to the alignment of the canal. » I have referred to the guard walls and the guide walls. I might state that for the large locks in the United States we generally use conduits in the walls and side openings into the chamber through the side of the walls. The only cases that I know of in which there are openings in the bottom of the locks are at the Keokuk Lock, and the St. Mary's Canal Locks and I believe they have had quite as much difficulty with such bottom openings as we have had at the other locks with side openings.

M. Müller (in French). — Mr. President, Gentlemen.

I am going to speak to you of a particular question which concerns my country, and which perhaps seems to you to be outside our present discussion to-day. But I already expressed our point of view last year, at the meeting on July 7th of the Permanent Commission when the programme of the questions to be submitted to the Congress, was drawn up and the Commission admitted this point of view. I refer in this respect to the proceedings at the aforesaid meeting of the Commission (page 20 and 21.)

I then said that Czechoslovakia comprises the parting line of three great navigable rivers declared international : the Elbe, the Oder and the Danube, whose improvement and joining up by canals have long been made the object of investigations.

The great expense which the carrying out of such works necessitate, imposes the most complete and most economical utilization of water courses, not only for navigation itself, but also as much as possible for other purposes, such as the production of power, irrigation.

Thus, as the French Delegate observed this morning, with us it is a question of rivers whose discharge is very variable.

Their flow must then at first be regulated so as to make it less variable, which leads to the construction of large reservoir-dams whose levels will be variable. I can cite as exemple the Elbe on which we are constructing near Usti a large dam with a 63 meter lift, and 300 meter cubes per second can be used there for producing power of 18,000 HP. But the discharge of the Elbe has enormous variations ; while its minimum at Usti, in 1911, was only 47 meter cubes per second, in 1890, its maximum discharge reached 4.500 meter cubes. Thus as I have pointed out, it is now proposed to equalize these differences by the construction of reservoir-dams located in the valley of the river. But these dams must not form an obstacle to navigation, therefore means must be found to pass through them easily.

Moreover, it is necessary to open up to navigation or to utilize the power of less important streams having a swifter current on which the rafting of trains of timber is carried on. The timber trains pass through the dams having a slight fall easily by drift-chutes ; for dams having a greater fall, that becomes more difficult and for the falls above 20 meters it is a problem for which no solution has been found up to now. We had hoped that in other countries a practical solution might have been found of the problem which concerns us and which was applicable as much as to the transport of boats as to rafts.

But in the reports we do not find such examples. We should be nevertheless desirous to know the opinion of the Congress on this question as it is very important for our country.

As to the reports presented to Congress I take the liberty of making a few remarks :

In general the question we are discussing is connected in certain respects to the question we have discussed this morning ; that is

to say « the utilization of navigable waterways for the production of power, its consequences and its applications » because in the case where the utilization of water for other objects than navigation alone is admitted the question presents itself to know whether the expense incurred for the purpose of economizing water is not compensated by the price of the power gained or increased.

That seems to me particularly to be the case for the application of M. Denil's idea, which has been put in practice on our rivers in Bohemia, and especially on the Elbe canalized for drift passages. The results as regard the transport of rafts are very satisfactory, but there is a large consumption of water.

That is why the report of M. Van Wetter interested me very much. The reporter classes the streams into three groups. In my opinion it will not be easy to distinguish between the « passages with a fairly steep incline » and « passages with a steep incline ».

As regards the concrete cases cited in this report, it seems to me that the « Iron Gates » on the Danube belong rather to the second class. Moreover I also consider the question of the improvement of the « Iron Gates » as rather complicated and the necessity of utilizing power which may also be used for facilitating navigation must be taken into consideration.

The Germans laid down a railway at the « Iron Gates » during the war to tow the boats (solution which M. Van Wetter recommends for the second group).

As to the conclusions proposed by the General Reporter, the point of view set forth by M. Bourgeois is quite exact, if one keeps to the strict meaning of the question submitted. But, as I have said at the beginning it was well understood at the Permanent Commission that the special question which interests us in Czechoslovakia, namely the practicable means for boats to pass through the dams with a high fall and with variable levels might also be dealt with, a question which may also come up in other countries.

I beg you to recommend the study of this question. This request might be acceded to, under the form of a wish expressed by the Congress.

Mr. C. J. Griffiths. — I should like to be allowed to say a few words on this subject in which I have been greaty interested for many years past. We are all gathered together to give particulars of our experiences and our difficulties in providing facilities for navigation with a view to gaining information from each other, and it would be very helpful if each one of us could explain how they have overcome certain of the difficulties they have experienced. I desire to emphasize in the first place that our experiences differ so much.

It may be that in one case there is a canal with a low velocity, and a low fall to be dealt with, perhaps suitable for the use of small types of vessels only. The requirements of such a case are entirely different from the conditions which arise when you are dealing with vessels of some thousands of tons in large and swiftly flowing waterways. I should like, if I may, to give you my views first of all with regard to the question of the Ship Canal. I call it a ship canal, but I am thinking really of the remarks we have just heard from Colonel Oakes on the canals and waterways in America. There you are dealing with a much larger type of craft than is dealt with in this country, with the exception of the Manchester Ship Canal and the Gloucester and Berkley Ship Canal. With regard to the question of locks, I do not think any of us can say that we have yet found an efficient substitute for the lock. It is possible to provide elevators, but in my opinion the lock is up to the present the cheapest method for the transporting of a vessel from one level to another. You have seen the model of our small conveyor which, from my experience, I am satisfied can be adapted for a much larger type of vessel where necessary. I say that in all humility, for I was very sceptical of being able to succeed with even small boats in the first instance, but I think I can say with some confidence now that it can be used on a larger scale.

Conservation of water must enter largely into the consideration of what are the best dispositions at the lock or at the place where vessels have to be raised from one level to another, and that will govern the whole matter as I see it.

We next go to the question of capstans, tugs and other form

of haulage. I have seen three different methods adopted: capstans tugs and motor engines in the craft itself. My own view is that the motor engines in the craft itself is the most efficient; that the tug comes next, and that the capstans is third. My reasons for that opinion are that the motor engine is independent ; the tug is independent, but the barge which is dependent on the capstan cannot do anything until it has got its rope on to the capstan.

Colonel Saner, Dr. Wentholt and other speakers have referred to the question of the protection of lock gates. I had an experience some 25 years ago of a steamer running into one of the locks in the Ship Canal. The captain rang « Full speed astern », but the engineer went « Full speed ahead ». The steamer hit the lower gates ; the captain shouted to the engineer to go full speed astern, but he still went full speed ahead, with the result that he went right through the lower gates; and it was only because they were able to get the top gates away from the wall just a matter of six inches or a foot and the fact of the water dropping below drawing the gates together that saved a very great catastrophe. Only last Thursday when I went to Marlow Lock on the Thames, I was told that we had just escaped a very similar accident, a large launch in this question having gone ahead instead of astern. Therefore, in reference to the question of the disposition of locks, in my opinion it behoves all engineers to make provision against that eventuality, especially where the fall is great. I have learned by experience on the Thames that to facilitate traffic through the lock it is necessary to guide it into the lock, and you have doubtless had the same experience. I had the same experience on the Manchester Ship Canal. Unless you guide your craft at an angle into the lock, it is very much more difficult for that craft, which is subject to the force of the wind and the stream, to go into the lock.

Colonel Oakes has referred to the question of steel gates. My experience is that timber framing will stand more punch than steel, unless you sheet it.

Another thing that I have been trying to improve on the River Thames is the position of the locks. Many of the locks were originally built absolutely adjacent to the weirs. The millers had come along and said « We want a head of water to drive a

mill; we will built a dam across the river here ». This they did, and then to serve the navigation they formed a flash lock immediately adjacent to the weirs so that vessels were subject to the full force of the weir stream. In my opinion you should get your lock as far away as you can from any stream because that will greatly facilitate the navigation. Arising out of that I always try as far as possible to get my sluices to discharge as far away from the centre of the channel as possible so as to allow the stillest possible water for the craft to use when entering at either end of the lock. It appears to me arising out of the discussion today, and the most able papers that have been written on this matter, that we ought to try and put our heads together and form some generally acceptable conclusions. You already have before you the conclusions of the General Reporter which will be very helpful to you ; but I believe I am right in saying that the Chairman will accept suggested conclusions if you will be good enough to submit them to him in order that a Sub-Committee, which is in the course of formation, may have an opportunity of running through them with the object of endeavouring to co-ordinate them. I beg the Chairman's pardon for mentioning that fact ; my excuse for doing so is that I shall have to worry out some of the details.

M. Van Wetter (in French). — M. Denil, Chief Engineer of Roads and Bridges prevented from attending the Congress, begged me to make the following communication to the Section :

The Professor Klir, in his report, on the Second Question, expresses himself as follows :

« The Engineer A. Bazika constructed in 1912 (for the lift of » 3 m. 8. of the movable dam of Lovosice, on the Elbe in Bohe- » mia) a new kind of drift chute for the rafts.

» In general it is a canal 12 meters wide, the floor of which forms » an inclined plane of 1/35. The upper sill of this floor is placed » at 1 meter 05 below the level of the normal depth. Discharge : » 20 m^3 per second.

» Efforts were made to diminish the velocity of the water on this » inclined plane, by increasing artificially, the friction of the » water against the floor, by the use of cross bars placed in zigzag » fashion. and spaced 1 m. 50.

» These cross bars have pointed ends which jut out 0 m. 30 » above the floor ; the considerable friction which thereby results » decreases the velocity of the water so that it does not exceed » 2 m. 10 per second, and, in addition, remains even on the whole » length of the pass. Practicable trials have given very satisfac- » tory results ».

The characteristics of the pass for rafting constructed in 1913 at Lovosice, in Bohemia, are in principle to bring about a uniform current abated by methods appropriate to the floor of the channel.

The means employed consists of placing projections or mouldings laid out in zigzag or chevron form.

Now, the possibility of forming channels or passes, with eddying currents *uniform* despite the steepness of the slope, channels designed either for the going upstream of fish, or for the locking of boats, was confirmed and published in two papers by M. Denil *Les Echelles à poissons*, etc. (Annales des Travaux publics de Belgique, April 1909)) and *Les échelles hydrauliques appliquées à la canalisation des rivières*. (Annales de l'Association des Ingénieurs sortis des Ecoles spéciales de Gand, 1909, 5th Series, Vol. II, 2nd fasc.)

By a singular coïncidence the author mentions the drittways of the Moldau, and points out that no efficient measures have been taken to assure the slackening of the current.

The principle of the slack water channel, conceived in 1912 by M. Bazika was then brought forward by M. Denil. The publications of this author were moreover known in Bohemia.

Moreover, the very nature of the device adopted for the lay-out of projections, the principle of zigzag or chevron form, belongs without any doubt to M. Denil who, in the two papers cited, sets forth exhaustively and in detailed form, the result of experiments which show the considerable advantages that must be expected from mouldings or projections arranged in *chevron form*.

Finally, if it is true, that in the two papers of 1909, M. Denil had only contemplated the construction of a single series of mouldings in chevron form, in width, by passage, mouldings extending along the wall, from the commencement of 1909, in a new paper on: *La mise en valeur du réseau fluvial africain* (Annales des

Ingénieurs sortis des Ecoles spéciales de Gand, 1911, 5th Series, vol. IV, 3d fasc.) he expresses himself as follows :

« Under the form to which our studies have led us, the slack-» ening effect would be brought about by a series of floats laid » down in parallel longitudinal bands, so as to form a sort of » floor for reducing velocity ».

It is then proved that M. Bazika's patent can only practically bear on the cross section of « the moulding » or « projection » for reducing velocity adopted at Lovosice — the moulding gives but little satisfaction.

M. Denil since 1912, except for a period from 1914 to 1919 owing to the war, has tried to find out experimentally in a laboratory which he has been able to establish thanks to the generosity of the Agriculture and Public Works Department of Belgium, the practicable forms of « mouldings » which give the greatest efficiency in very different conditions. The result of this experimental work, nearly completed, has greatly exceeded the original estimates.

I finish this communication of M. Denil as well as my report by the following information :

The use of a lining of thin boards, investigated by M. Denil permits the reduction of 1/5 of the natural velocity of the water in a passage of 0 m. 60 in depth and inclined at 1/35 like the drift chute of Losvosice. In this the reduction of velocity was about 1/3, which demonstrates the preponderant effect of a cross-section as compared to the disposition in chevron form.

In my report I have cited as an example of the application of the Denil method, the improvement of the difficult channels of the regulated waterways like the Rhine and the Danube, as well as the canalization of rivers where it is not essential to economize the water.

The Denil method may also permit the suppression of guard-locks located above the canals branching of a waterway feeding these canals.

The Denil wainscotting could be also applied in the construction of locks for abating the velocity of the water running either from main-wall culverts, or lock-doors located after the new system

in Sweden and described in the report of Messrs Vinberg and Lavski.

Several members consider that the four first conclusions of the General Reporter are not connected with the question asked, because they consider the case of the use of the different ways of overcoming differences of level.

I pointed out that the study of the means of facilitating the operations leads logically to that of the case of application of the various ways of overcoming the differences of level, and that one hardly refrain from giving an opinion on this last point for instance, the practicable advantage resulting from the perfection of a type of structure is precisely to open up to the latter a more extensive field of application.

The Chairman. — It is now time for us to adjourn. The General Reporter, with the help of a Committee, will consider the various suggestions that have been made at the meeting to-day and will try and see if he can amend the conclusions to fall in with the views of the various Gentlemen who have spoken For that purpose I suggest that he should have the help of a Committee consisting of M. Bourgeois, M. Müller, M. Reigersman, M. van den Broeck, Colonel Oakes, M. Van Wetter and M. Wentholt. The conclusions at which they arrive ought to be ready when we meet here tomorrow morning, or at any rate some time during the morning.

I will now adjourn this meeting until 10 o'clock tomorrow morning, when the same subject will be discussed, and it will be open to any of the delegates who desire to do so to take part in it.

The meeting adjourned at 5 p. m.

FIRST SECTION

(Inland Navigation)

FOURTH MEETING

Wednesday, 4th July, 1923 (morning)

The Right Hon. Lord DESBOROUGH, K.C.V.O., in the chair.

The Meeting was called to order at 10 a. m.

The Chairman. — Gentlemen.

We are going to take up the question n° 2 of the first section, which question was the object of the discussion yesterday afternoon. Before opening the debate, I wish to read the new conclusions drawn up by the sub-commission which met after yesterday's meeting. It is on these conclusions that resolutions must be taken by the meeting this morning.

The Chairman reads the text of the conclusions in English worded as follows :

« *The operations required for passing boats through locks or by* » *canal elevators can be considerably facilitated and quickened up* » *by the following means :*

1. *A judicious location of the work in reference to the alignment of the waterway.*

2. *The provision at each lockhead of a lie-by provided with guides, and large enough to hold all the boats to be passed through at one locking.*

3. *The adoption, on the one hand, of a sufficiently large relation between the respective water sections of the lock entrance and of*

the boats, and on the other hand, of a sufficient excess of the available length of the lock chamber over the train to be locked.

4. *The adoption of appropriate means of traction. This essential point has not been solved satisfactorily in all cases and therefore further investigations and trials should be made, special regard being paid to locks of high fall.*

5. *The introduction of mechanical working of the various parts wherever their dimensions and the volume of traffic warrant it.*

6. *The installation of lighting at the lock and in the vicinity, allowing of working at night with safety and rapidity, when the traffic warrant it.*

7. *It is understood that in the case of locks, these should be provided with proper arrangements for rapid filling and emptying without producing currents which may cause disturbance, either to boats placed in the lock chamber, or to those awaiting locking.*

M. Popesco (in French). — I find that the question of the improvement of navigation in the rivers or in the sections of rivers with variable levels and rocky beds has not been sufficiently insisted upon.

There are parts of the river where derivation canals cannot be constructed, owing to the rocky banks, nor can the clearance of the rock be carried on, because of the lowering of the level of the water in the upper sections. In such cases it is necessary to construct dams with locks in the bed of the canal itself. The existence of two secondary channels are generally taken advantage of to construct on one channel, the dams, on the other channel, the locks.

The most striking example is that portion of the Bavarian Danube known as the Bavarian Kachlet, and that portion of the Danube known as « Iron Gates ». In these places it is necessary to construct the locks in the bed of the river itself.

We must then state exceptional cases of this kind in our resolutions.

I propose then to insist on having in our conclusions an article drawn up in the following manner :

« *In special cases where navigation requires an increase of depth*

» *in the sections of canals with rocky bottom, and there where a* » *derivation is not possible, locks must be constructed in the bed* » *of the river. Such works might be arranged to serve both for* » *navigation and the production of power.* »

M. Van Wetter (in French). — I cannot agree with the new conclusions proposed, because in fact they only partially answer the question submitted, which question refers not only to the locks, but also to the elevators, the inclined planes and other means of overcoming differences of level.

Now all the new improvements particular to the means of locking other than the lock itself have been omitted from the programme although several reporters have described the new arrangements as facilitating the operations.

In addition, the comparisons which one is inevitably induced to make between the various means of overcoming the differences of level after an examination of the improvements of which they are susceptible, are not outside the question submitted.

Among the improvements adopted and which do not apply to lock-chambers, I cite the following :

I. Elevators and inclined planes in which the boats are transported afloat.

One of the most delicate points of this kind of structure is the junction between the lock-chamber and the reach, because it must be procured in a sure and rapid manner, avoiding, as much as possible adjustments for guarding against variations of temperature and level. The arrangement made in the last three elevators of the Canal du Centre includes all the advantages of the systems previously applied, without their disadvantages.

II. Inclined planes in which the transport of boats is done on dry land.

The rolling floor arrangement introduced on the Thames seems to me to constitute an excellent solution for pleasure boats in the case of intense traffic and a limited supply of water.

III. — Navigable passes with a steep superficial incline.

This means of overcoming the differences of level was formerly employed in locking.

It comprises a sluice with a dam which was suddenly opened after provision of a reserve of water procuring a sufficient depth. This kind of locking had to be abandoned owing to its intermittent working and because it was not of assistance to boats going upstream; but it is evident that it can be again taken into consideration, if the velocity of the water in the channel can be reduced to one tenth or more. In this respect the arrangement of floats for abating the current, of M. Denil, appears to me worthy of retaining the attention of Congress. This system is not the result of mere speculation, but the result of practical trials methodically and patiently carried on for years.

I consider that it constitutes an interesting solution for navigable waterways with heavy traffic, and where the reduction of the consumption of water to a minimum is not essential.

The Chairman. — I understand that M. Van Wetter rather complains that in our conclusions we have omitted almost every means of raising boats from one level to another, except that of locks.

M. Van Wetter (in French). — No, not precisely, but all the improvements which are special to types of structures other than the lock for overcoming differences of level, have been excluded from the conclusions.

The Chairman. — Well, that is what I was trying to say. What we say about locks is all right, but you rather complained that we omit reference to other means, such as elevators, inclined planes and so on. Well, I must say, I believe there is a certain amount of justice in that complaint and if you would insert something to make it more practicable, I think the Congress might consider it.

M. Klir (in French). — At the end of the last meeting and again to-day the Belgian Delegate M. Van Wetter alluded to a part of the report presented by me at the Congress and which he read. The object of these observations made in the name of M. Denil, Chief Engineer at Brussels was to lay claim to the invention of

the devices applied on the Elbe in Czechoslovakia for the construction of floating sluices for rafts near Slovosice, after the patent of M. Bazika, Engineer.

I find first of all that it was my duty as reporter on question 2 to mention that this new system of floating sluices for rafts, which has given satisfactory results, as serving at the same time as a fish ladder, is really identical to that of M. Denil's. If M. Denil thinks that his patent rights or other interests have been injured by this construction, it is there a strictly private question which cannot be the object of a debate in this assembly.

Besides, I entirely maintain the opinion expressed in my report that in the special cases, where it is a question of transporting the rafts through a 50-70 meters fall of the large reservoir-dams which serve at the same time for the *production of power*, the system of floating sluices is not from an *economic* point of view, a solution to be recommended on account of the very considerable consumption of water.

Mr. Reigersman. — Mr. Chairman, I am opposed to the conclusions M. Van Wetter has come to about the Deuil principle. The Denil system is to my mind the means of dealing with differences of level in itself, and not a disposition or an arrangement to facilitate the same ; and it is only with dispositions and arrangements of that kind that we have to deal now.

M. Bourgeois. — Mr. President, Gentlemen.

The preceding speaker has already given the answer which I proposed to make. I shall add only one or two words.

To satisfy the demand of Messrs Van Wetter and Müller we have tried to come to an understanding

We suggest putting a paragraph at the head of the conclusions which would give every satisfaction. Moreover, it has been read by M. Antoine. This text is as follows :

The dispositions or arrangements to be adopted to facilitate the passage of boats through locks, by elevators, inclined planes, and other means of overcoming the differences of level, depend on a number of considerations, especially on the system of the work,

the importance of the traffic, the type of boat, the height of the fall, etc.

It is not possible to give precise indications on this subject which are applicable to every case.

The following means appear, however, to be advisable as generally susceptible of facilitating and accelerating the operations.

It is the direct answer to the question which has been submitted to us.

The leading paragraph concerns various kinds of works now in practical use, especially the locks and the elevators, and concerns generally the inclined planes, although there are none in operation for the large boats.

Consequently, endeavours have been made to draw up an answer as general as possible, and in these conclusions are included the new types of works which could be tested and then put into operation.

The type of work which has just been described is rather, the improvement of a special passage of a free flowing river, and does not enable the differences of level to be overcome. The arrangement of regulation is a solution of the problem.

Consequently, I do not think it is possible, considering the question submitted to us, to speak of this special arrangement of a free flowing river.

The different recommendations which are given in paragraphs I to 6 apply to elevators, inclined planes, locks and other means. An arrangement regarding the approaches is also necessary

Moreover, we did not say that the question only concerns locks.

In the other paragraphs, the words « locking » and « lockage » were adopted ; but these words apply as much for the inclined planes as for the elevators : it is an operation of a boat going up and going down stream.

Because we see the words « locking » and « lockage » it is not a reason to think that we are only dealing with locks.

Mr. Lawski. — The first canal of the Swedish canal system, the reconstructed Trollhatte Canal, between Lake Vänern and the Categat, opened in 1916, is built for vessels with a draught of 4 m. (13 ft) but the locks are built for vessels with a draught of 5 m.

(16 1/2 ft.). The mitering gates and their electrically driven operating gears are of types similar to those used on the Panama Canal. They act satisfactorily, but it is necessary to avoid freezing up in winter in the angle between the gate and the wall, and that is why the turning-posts are warmed electrically.

The arrangements for filling and emptying the lock comprise a bottom channel under the lock-chamber, in which the water is distributed over the whole area of the bottom of the lock-chamber. This arrangement has proved very satisfactory, but of course it is only suitable for locks blasted out of the rock, as they usually are in Sweden.

A safety-chain for the lock-gates has been introduced at one lock, in order to obtain experience, but it is not used, and I think that in the prevailing circumstances, such an arrangement is not necessary. The large vessels go very slowly and cautiously into the lock, and the risk of their damaging the gates is small, as the gates have proved strong enough to withstand turns from tug-boats.

The sluice gates in the sluice ways are of Stoney pattern. This type was chosen in order to prevent the sluice-gates from freezing up in winter, but after our experience, I think gates with great fixed rolls would be preferable.

For the new lock at Södertälje, between Lake Mälaren and the Baltic, which was opened this year, and also for the new lock at Stockholm, lock-gates of a new type i. e. sector type, have been constructed, and I beg to call your attention to this type. The plating of the gate forms a vertical cylinder with sector cross-section, and with the axis going through the bearings of the gates. According to this construction, the gate can take up water pressure from one side as well as from the other, it can be operated in streaming water, and can be opened against the prevailing water pressure.

The gates are arranged with a pair of gates at each end of the lock, and by filling and emptying the lock the water passes between the sector gates, and *around* them through the gate niches. The gates and their niches thus serve themselves as arrangements for filling and emptying the lock, no separate sluice-ways having been constructed.

Several gate types have been under consideration for the lock of Södertälje, and our last choice stood between roller gates and sector gates, but we preferred the latter, as they were cheaper and simpler of operation, shorter time was required for sluicing (a very quiet sluicing), and greater security for the operation of the gates in all circumstances.

If a gate should be damaged, it can be rotated into the gate-niche, which can be emptied after a pontoon wall has been placed before the opening. A reserve door-gate is arranged on the pontoon, and so tightens against the other sector gate that the traffic can go on without disturbance for vessels of a breadth less than 15 meters (the whole width of the lock opening is 20 meters). This type of gates also solves the problem of emergency gates. If one pair of sector gates is damaged, and the other pair is opened or under operation, the undamaged pair of gates can be shut.

Such gates would be suitable for locks in connection with lakes or tidal seas, where the water-pressure changes of direction. At the above mentioned locks in Sweden the difference in water level was not great (under 2 meters, 6 feet), and we have no experience if they are suitable for high differences in water-levels, but from the model tests we have done, no impossibilities have been met with. It is only necessary to open the gates very slowly, and at first little, so that the quantity of water runs through in the time unit will not be too great.

But this is necessary also for sluice-gates in sluice-ways, if one wishes to obtain a quiet sluicing. For large locks with electrically operated sluice-gates, the opening of the gates should be regulated in proportion to the water height, so that the opening should be very small when the water pressure is at a maximum, and gradually increased so that the largest possible opening is obtained during the last stage of the sluicing.

M. Müller. — Mr. President, Gentlemen.

The conclusions proposed by the sub-commission and which have been read to the assembly, do not give me full satisfaction. I must come back to the question which I dealt with yesterday,

that is to say the dispositions and arrangements to be adopted for dams of great height and variable level.

You have heard the Roumanian Delegate who stated that his country is interested as much as mine in the question. It is not a question of the regulation of a free flowing river, as M. Bourgeois believed it to be, it is a question of the canalization or, if you like, the utilization of power and at the same time of navigation. We wish to construct dams from 50 to 70 meters in height, but we do not wish to interfere with navigation, we even wish to make it possible, there where up-to-now it was impossible. It is a difficult question ; for if the water of these reservoirs is used for some purpose, whether for the generation of electrical power, or for irrigation, etc., their level will be variable. Now it is a question of finding means to enable boats to pass through such dams. That is the question which we have treated.

You now find that this question is not connected with the question submitted, I see however — and I have already cited — that the proceedings of the Permanent Commission distinctly admitted the examination of this question.

If however, the Congress is of opinion that the question we are dealing with is not connected with the question submitted, I shall be very sorry, but I shall express the wish of seeing this question investigated. It might perhaps be put in between the conclusions you have prepared at the end of the 2nd new paragraph.

In any case the study of the question of crossing over the high dams is to be recommended.

M. Mahieu (in French). — We must abide by the conclusions, and make a recommendation.

M. Müller. — There are also other countries which are interested in the question, consequently, I beg you to take our wishes into consideration. The text which I should eventually propose as the last new paragraph is the following :

For the other means of overcoming the differences of level, it is recommended to study especially those constructions which are adapted so as to permit the passing of weirs of great height and

with varying levels, which are designed to serve both for navigation and other ways of utilizing the water.

The Chairman. — Some little difficulty has arisen ; our conclusions were supposed to be too much with reference to locks and rather to omit the other means of raising boats from one level to another ; but I understand that the word « lockage », in France, would apply to all those various means, other than locks, of raising boats from one level to another. Therefore, the french text can very well be adopted; but our French friends have suggested that a preface to the conclusions should be inserted, and this preface reads as follows :

« *The dispositions or arrangements to be adopted to facilitate* » *the passage of boats through locks, by elevators, inclined planes,* » *and other means of overcoming the differences of level, depend* » *on a number of considerations especially on the system of the* » *work, the importance of the traffic, the type of boat, the height* » *of the fall, etc.*

» *It is not possible to give precise indications on this subject* » *which are applicable to every case.*

» *The following means appear, however, to be advisable as* » *generally susceptible of facilitating and accelerating the opera-* » *tions.* »

M. Antoine reads this preface in the french text.

The preface is adopted by the section.

The Chairman. — Now the *first resolution* applies to all means of raising boats, and is very important, I think, because it deals with the alignment of the waterway which is very important on the Thames :

1) *A judicious location of the work in reference to the alignment* » *of the waterway.* ».

M. Antoine reads the french text.

This first conclusion is adopted by the Section.

The Chairman reads the *second conclusion.*

2) *The provision at each lockhead of a lie-by provided with guides, and large enough to hold all the boats to be passed through at one locking.*

M. Antoine reads the french text.

The second conclusion is adopted by the Section.

The Chairman reads the *third conclusion :*

3) *The adoption, on the one hand, of a sufficiently large relation between the respective water sections of the lock entrance and of the boats, and on the other hand, of a sufficient excess of the available area of the lock chamber over the train to be locked.*

M. Antoine reads the french text.

M. Cevaert. — President of the Permanent International Association of Navigation Congresses (in French) :

Gentlemen,

There is to my mind an ambiguity in the french text : when it is stated « sufficient excess of the available area of the lock chamber over the train to be locked » it seems that a connection is established between the two things : the length of the lock chamber and the length of the train which is waiting before the lock.

It is on the contrary the assemblage of boats in the lock which constitutes a new form of the convoy, and it is there where the excess must be.

It must be stated : « *the adoption one hand, of a sufficiently* » *large relation between the water sections of the lock entrance* » *and of the boats and on the other hand, a sufficient excess of* » *the available area of the lock chamber over the train marshalled* » *for locking* » because the convoy presents itself with its tug and boats in a line.

M. Mahieu. — The precision of M. Gevaert is very judicious.

The third conclusion thus modified is adopted by the section.

The Chairman reads the *fourth conclusion:*

The adoption of appropriate means of traction. This essential point has not been solved satisfactorily in all cases, and therefore further investigations and trials should be made, special regard being paid to locks of high fall.

M. Antoine reads the french text of the fourth conclusion.

The fourth conclusion is adopted by the section.

The Chairman reads the *fifth conclusion :*

The introduction of mechanical working of the various parts, whenever their dimensions and the volume of the traffic warrant it.

M. Antoine reads the french text of the fifth conclusion.

The fifth conclusion is adopted by the Section.

The Chairman reads the *sixth conclusion :*

The installation of lighting at the lock and in the vicinity, allowing of working at night with safety and rapidity, when the traffic is sufficient to warrant it.

M. Antoine reads the french text of the sixth conclusion.

The sixth conclusion is adopted by the Section.

The Chairman reads the *seventh conclusion :*

It is understood that in case of locks, these should be provided with proper arrangements for rapid filling and emptying without producing currents which may cause disturbance, either to the boats placed in the lock chamber, or to those awaiting locking.

M. Antoine reads the french text of the seventh conclusion.

M. Cevaert (in French). — Gentlemen,

I do not think it opportune to introduce this last new paragraph

in a precise numbered form. It is simply necessary to say « It is » understood, etc., etc. »

I propose to suppress the numbered form 7° and adopt the aforesaid text added to the other six conclusions.

The Chairman calls on the Members to vote on the resolution which has just been read. It is adopted by the Section, who also agree with the amendment of M. Gevaert which consists of suppressing the numbered form 7°.

M. Mahieu (in French). — When M. Müller formulated his observation about the crossing of high falls, I remarked to him that this question was not in the order of business of the Congress. It is not possible to solve it at this moment.

The Section could express the wish that the question of the passing over high falls be discussed in the next Congress. Only, it cannot be discussed except in the presence of engineers and technical navigators.

I have drawn up the following desiderata, which could be adopted in this order of ideas.

M. Antoine reads the desiderata, the text of which is as follows :

« The Congress expresses the desire that the Permanent Commis- » sion of the Association of Navigation Congresses have the pro- » blem of the crossing of high falls studied at the next Congress. »

M. Müller. — I thank M. Mahieu for his proposal to which I agree. Only I should like to see a slight modification brought to it. I should like this to be added « especially in reaches with variable levels. »

The Chairman. — I understand that this resolution would not be one of the resolutions before this Congress. but would be a communication to the Central Association in Brussels, that at the next Congress special attention should be paid to the very important question of overcoming high differences of levels in moving boats from one level to the other, especially in the case where those levels should vary.

The desire, completed with the addition by M. Müller, is adopted.

The Chairman. — M. Van Wetter who wishes to propose an addition to the resolutions which have just been adopted, has the floor.

M. Van Wetter (in French). — In the construction of elevators and inclined planes, it is interesting to realize a system of a junction between the lock chamber and the reach that adapts itself automatically to the differences of level, and to the variations of temperature, without it being necessary to proceed to a special regulation for each operation. I should like the Congress to insist upon this point in a resolution.

M. Mahieu (in French). — It is necessary to go into such a detailed account of the canal apparatus ? All the details of the locks and their parts would then have to be included into the conclusions. If you want to add anything to the conclusions, do so in a more general form; or what is still better, content yourself with expressing a wish.

Colonel Oakes. — I suggest that the matter should be referred to the Special Committee for further consideration, and then be brought before the Congress with the approval or disapproval of the Special Committee.

The Chairman. — I believe that the matter had better be settled at once. *(Assent of the Section.)*

M. Van Wetter. — I insist that my proposition be taken into consideration by the Congress. Having been in charge of a department where I have had the opportunity of examining the working of four elevators, I can speak in having first hand knowledge of the question which I have raised.

I therefore formulate my conclusion :

« In the construction of elevators or inclined planes, where the » transport of boats is done on water, it is interesting to realize

» a system of junction between the lock chamber and reaches,
» which adapts itself automatically to the differences of level and
» the variations of temperature. »

Mr. Sidney Preston. — It seems to me that the points for the consideration of the Congress are general principles and not the rather minute details of some particular work. No doubt the points that M. Van Wetter has raised are very important and are referred to in his paper ; but I venture to think they are purely a matter of engineering detail, and have really nothing to do with navigation I therefore oppose the additional resolution.

M. Cevaert. — Mr. President, Gentlemen,

I see myself bound to adhere to the opinion of M. Mahieu and the General Reporter, then I think that my compatriot M. Van Wetter, who has profoundly studied the problem of elevators, has given some very judicious observations, but it is none the less true, that a detailed description of the construction of canal parts and apparatus cannot be entered into and that consequently, the motion put forward is not a resolution within the province of the present Congress. I ask my compatriot not to insist any more on this question. The observations which he has made will be included in the report of proceedings.

If they are considered important enough to be examined by the next Congress, they will be put in the order of business of this Congress.

The Chairman. — M. Van Wetter, do you consent to withdraw your proposition ?

M. Van Wetter consents to withdraw his proposition.

The Chairman. — The resolution is withdrawn, but I understand there is a second resolution.

M. Van Wetter. — The second resolution which I desire to submit to the Congress consists of the following addition to the con-

clusions already adopted: « The type of elevator with dry summit is a solution particularly interesting in the case of a navigable river used by numerous pleasure boats ».

This resolution voted on, was rejected by the Section.

The Meeting closed at noon.

FIRST SECTION

(Inland Navigation)

FIFTH MEETING

Thursday, July 5th, 1923 (morning)

Mr. SIDNEY PRESTON, C.I.E., C.B.E., in the chair.

The Meeting was called to order at 10 a. m.

The Chairman. — Gentlemen, I regret to say that the Rt. Hon. Lord Desborough is unable to be present this morning and Sir Maurice Fitzmaurice has to attend a Royal Commission; I have therefore been asked to take the Chair today. I will now ask Mr **Sandeman** to introduce his paper. He is General Reporter on the second subject.

Mr. Sandeman, then reads the remarks and the Conclusions of his General Report on : **The influence of surface water and subterranean sheets of water on the flow of rivers. Regime of mixed-canals ; estimation of the water consumed for navigation and irrigation uses ; the portion returned to the subterranean sheet of water.**

This communication has been dealt with by Messrs. Daniel W. Mead (U. S. A.), Dienert (France), de Carle Salter and Reed (Great Britain), Wallen (Sweden), Kobza and Hengenius (Czechoslovakia).

Mr. Sandeman made the following additional comments : (Having read to the words) « is not unusual » : In regard to that point I may say we have exceptional cases in this country where the flow goes up tot I cubic foot per second and even higher than

that. « The latter, that is the extreme maximum discharge would depend upon combined conditions » (Reading to the words) « in some cases ». I may say that on rather small areas I have myself recorded as much as 23 ins, of loss in this country. But that is in the Southern part of England, or rather in the Southwest part of England, and the areas were not large. « Ordinarily it may be taken » (Reading to the words) « reservoirs ». This is an important point which is not quite obvious to people who have not had experience of water being stored in valleys. Those of you who have such experience have found in all probability that, where a dam is placed across a valley, the storage of the reservoir is not just that which the measurement would give, but in some cases it is very much higher because the water percolates into the hill sides and one gets a very much larger storage than one originaliy expected. It is this water which comes out when the reservoir is lowered which alters the yearly calculations of flow; and it interferes with the ordinary measurements which we take to ascertain the evaporation losses. We include in evaporation losses generally losses by absorption and percolation; that is percolation of water into the ground which gets away into some other watershed. « The losses by evaporation absorption » (Reading to the words) « 1400 feet above sea level ». This watershed referred to is on the borders of Yorkshire and Derbyshire. « Here the maximum losses » (Reading tot the words) « of 47.65 inches ». It is to be noticed that the average rainfall was 40.4 ins. « The minimum loss of 9.28 ins. which is just about half the maximum, occured with a rainfall of 24.8 ins. (Reading tot the words) « has proved a most useful one » I should say in regard to the form of that diagram that so far that I am aware, it is of American origin. Personally I have found it an extremely valuable means of recording flows and a very valuable means of comparing the flow of one watershed with that of another. « This watersned has an area of 32,000 acres » (Reading to the words) « near to the average ». I may say in regard to these records that at the end of the period of 6 years, the reservoirs were completed on the areas and they were filled, and the consequence was that all future records were interfered with as regards the evaporation losses in a most remarkable way, and it was found to be

impossible really to establish what the annual evaporation losses were, because there was so much water stored in the hill sides which it was impossible to measure, and this went into the hill sides and came out again at different times and so upset the annuel records of measurement, although over a period of years no doubt the average is correct. « Diagram 4 shows » (Reading to the words) « construction of canal, etc. » I think the losses depend particularly on the size and manner of construction. « Evaporation would be approximately » (Reading to the end words) « Branch canals ». I should like to add that an additional paper has been sent in by M. Kobza. It was forwarded to the Secretary and it deals with works being carried out at present on the middle Elbe for the improvement of navigation, the production of electrical power and for the improvement of agricultural land in the vicinity of the river. I understand however that, as it was impossible to translate and print this paper in time for the Congress, the author proposes at some future date to give another paper dealing with this work when it has been completed. It is very unfortunate that the engineers in England are dependent for information regarding stream flows and other points dealing with irrigation and water supply on information collected by private people, by public Corporations, by Water Compagnies and others, and that the Government does not do anything in the way of providing money to facilitate the collection of reliable data. The unfortunate part of this position is that when we collect data from different works, we find that we have records from weirs of different construction, and that the methods of measurement on the different streams differ also. We also find that the formulae used by the different engineers to compute the quantity of water flowing are at variance; and we very often find that the basic data of the rainfall itself are not beyond doubt. The Government here has been recommended by various special Committees which have sat during the last fifty years to set up an organisation which would deal with records of, and the allocation of the water resources of the country. Quite recently in the last two or three years, we were quite of the opinion that something was going to be done, because the Government set up a Special Committee to deal with the water resources of the country. That Committee sat

for two or three years spent a vast amount of time and work upon the subject and then issued a report which has been consigned to the usual pigeon hole, or perhaps I might translate it, the waste paper basket. What we really want is to have an organisation which would control the compiling of records, which would standardise the means of measurements and the formulae to be used, so that the results could all be compared. I suggest therefore for discussion that, if it be possible, an International Committee be set up first for the purpose of compiling records already obtained; second, to consider and decide upon the best methods to be employed in obtaining reliable information on this question in the future with the object of making recommendations for the adoption of uniform methods of measurement and for the collection of records.

In conclusion, I should like to say that I wish to express to Mr W. A. Legge, Member of the Institution of Civil Engineers, my thanks for the great assistance he has given me in dealing with these reports.

The Chairman. — Gentlemen, this is a subject which has been of very great interest to me personally during my service.

I have been employed during the whole of my service in India, which extended for well over forty years, in irrigation works, where the losses of water brought into the canal at very great expense are very heavy. It seems almost extraordinary, but it is a fact that the figure which Mr. Sandeman gives of 8 cubic feet per million square feet of sectional area is a figure that we arrived at, but that is only in the main canal and branches. Besides that there is a loss in the major distributories, the minor distributories, and the field channels ; so that we calculated that of the large volume that we took in from the rivers coming from the Himalayas, not more than 25 per cent reached the field. It is a very remarkable figure, but that is really what we found. Then later on in my service, after I retired from Government service, I was for some years working in Central India. There the work was entirely in the formation of reservoirs to hold the rainfall and distribute it also for irrigation. There I experienced the very greatest difficulty in getting the very particulars which Mr. Sandeman refers

to ; in calculating probable run off I had to use the coefficients obtained by Binny's experiments in Nagpore, which are tabulated in Molesworth's Pocket Book. We had really no other information to go upon. Then, as Mr. Sandeman quite rightly says, we were all individual engineers each trying to get information ; but it was not co-ordinated : there was no Government Department to do it.

He is also perfectly right with reference to the want of accuracy there is in statistics. I can tell you of a fact which came to my knowledge. We had rain gauges distributed all over the country, and the petty native official called there a Teshildar, was put in charge of them. The Teshildar on one occasion was seen pouring water into the rain gauge. He was asked what he was doing that for ; « Oh » he said « the Sahib is coming round this morning and he always gets very angry if there is not some water in the rain gauge ». Those are the sort of statistics we have go upon So that I can cordially agree with what Mr. Sandeman says, that we want some co-ordination ; and in my view- being an old Government official perhaps I have rather a higher opinion of Government work that many men who have not worked for the Government- I think it ought to be under Government control.

I will ask Mr. Wentholt to open the discussion.

Dr. Wentholt. — Mr. Chairman and Gentlemen, the question which occupies the Congress at this moment, has interested the engineers in Holland for many years in a high degree. In the lower part of our country the water which falls does not run off by river, but as that part of our country is below sea-level, it has to be pumped out, special canals being constructed to conduct the water to the pumping plant. There are, as you will know, a great many of these pumping plants in the Western part of Holland. When we have to fix the capacity of our pumping plants, we have to know what proportion of the total rainfall has to be pumped out. This is of prevailing importance, for if the pumping plant is not large enough the whole area becomes flooded, while on the other hand the pumping plant costs a great deal of money and therefore we do not like to make its capacity too great. I will not give you figures about the greatest rainfall in our country ;

I do not think they would interest you. But what is of more general importance is the part of the total rainfall which must be pumped out ; and it is with regard to this question that the experience gained in Holland is, I think, rather interesting, for the same quantity of water which must be pumped out in our case, will in higher countries flow of through the rivers. The drainage area of every pumping plant is exactly known. The same is the case with regard to the rainfall and with regard to the quantity of water which is pumped out, and therefore we know, much more exactly than it is possible to do when the water flows off in rivers, the relation between rainfall and run off in the different parts of the year. About 70 years ago there was in our country a large lake, the name of which was the lake of Haariem. Our Engineers have built a dam round this lake and pumped it dry. Since that time it has become one of the richest parts of our country and exact statistics have been made from the beginning with regard to the rainfall and the quantity of water pumped out.

It is because of these facts that we know over an area of 70 square miles exactly which part of the rainfall flows off and which part has to be pumped out, in every part of the year. In December, January and February, it is about 100 per cent ; as there is no evaporation : in March it is still 80 per cent ; in April 45 per cent, in May 20 per cent, in June and July about 11 per cent ; in August, in which month there is much rainfall, 18 per cent : in September 42 per cent ; in October 57 per cent ; and in November 84 per cent. All these figures are averages over more than 50 years. You see that the proportion of the rainfall which flows off depends in our country in a high degree on the evaporation ; and it is to be remarked that where there is much agriculture the flow off increases in a high degree after the time of harvest. This is, I think, because of the fact that the evaporation takes place by means of the leaves of the plants.

M. Puig de la Bellacasa. — Mr. Chairman and Gentlemen, allow me to say a few words on the subject submitted for discussion, especially on the influence of surface and subterranean waters on the flow of rivers, confining myself to countries like the central plateau of the Iberic Peninsula known as the « Mereta

Iberica » which constitutes 50 per cent of the whole surface of the Peninsula.

The Mereta is surrounded by mountains where the rainfall is not scarce, but on the plateau itself the average yearly rainfall is only between 400 m/m (16 ins) and 600 m/m (24 ins). The climate is therefore dry and, on account of the latitude, rather hot, which accounts for the active evaporation which varies from 45 to 50 per cent of the rainfall.

The surface ground is chiefly constituted of permeable tertiary rocks, sands and sandstone often covering impervious clay, and the rainwater which is not evaporated filters through, coming out in springs or through percolation in the valley slopes, giving birth to the torrential rivers of the country. The flow of the river is therefore chiefly affected by these waters of subterranean origin. Only near the Pyrenees are important torrents formed by superficial waters derived from the melting of the snow; and also in exceptionally rainy period or heavy rainstorms, the permeable rocks of the Mereta may be saturated at least on their surface and therefore cause an important quantity of water running superficially which rapidly increases the flow of our torrential rivers to such an extent that it often varies in the ratio of 1 to 500 and in some years in the South of Spain to 1 to 1000.

The regulation of these rivers to make them navigable is not practicable in most cases, but our engineers endeavour to increase their flow during the low water season in order to improve the irrigation of their valleys and the utilisation of their energy for motive power.

Years ago some engineers thought that the rainfall could be increased by afforestation, that is, planting trees on the slopes of the mountains of the river basin; but nowadays everybody is convinced of the slight influence of vegetation of any kind on the rainfall and the planting of trees and shrubs on the slopes and mountains is now carried on chiefly to consolidate the ground and to facilitate to a certain extent the filtration of the rainfall water, and decreasing the rapid run of the surface water which produces the abnormal flows and inundations. But the most effective way of stopping these and regulating the flows — at least in regions like our Mereta — is, in the opinion of our engineers, to establish

reservoirs in the river itself or in its tributaries, choising sites where the physical, topographical and geological conditions are most suitable for the purpose.

As I consider that this method of modifying the influence of surface waters on the flow of the rivers is worthy of very special mention, I submit to the first Section of the Congress whether it is suitable or not, that it should be taken into consideration amongst the conclusions referring to the communication under discussion.

At the same time I have heard what has been said about the methods of gauging the rainfall and the river flow. In Spain we are convinced that the best methods are those that work automatically, that is to say, recording like the barograph with the well-known system of a cylinder worked by a clock-work, but recording of course the height of the water inside the pluviometer. That is the only way that is reliable for our country, because our southern people have really got too much imagination, and very often, unfortunately they take records for a certain time but then they do not take the trouble of going to the river or going to the pluviometer to register it, — they make it what they think it would be. So it seems desirable that everywhere the pluviometers and fluviometers should work automatically to avoid errors and record in a continuous way the phenomena. For this purpose and others it will be convenient that an International Committe should be appointed.

M. Dienert (in French). — Mr. President, Gentlemen.

The different Reporters and the Reporter General have chiefly dealt with in their reports, of the estimation of surface water in the feeding of streams. Moreover, they showed us how to understand the height of « rain » water registered in the different water gauges. This is very interesting ; but the most important question submitted has been left aside: that of the regime of mixed canals; the estimation of water consumed for the needs of navigation and irrigation, the part returned to the subterranean sheet.

In France, there only exists a mixed canal, that of the Midi, the construction of another was considered during the improvement of the Rhone.

In France we have very little information about the portion returned to the subterranean sheet. It varies certainly according to the ground, and the way of irrigating the soil. What we know in France, and what I indicated in my communication, relates to the Northern regions. We have no figures concerning the Southern regions of our country.

A recent work of M. R. I. Mecker (1) shows that the Americans have long been interested in this question, and have figures varying from 35 to 65 %, that is an average of 50 % which is the figure which we find for the North of France.

We have sought information in Spain. It was negative. The engineers consider that the part returned varys from 0 % to 30 %.

A very important Italian work on this subject was announced. Unfortunately, it will not be presented to the Congress.

In my opinion this question should be studied in Europe in a scientific and rational manner, in order to know the quantity which is lost during irrigation and that which flowing into the subterranean sheet, can be recovered for the feeding of mixed canals.

We express a suggestion in this sense.

M. Cloushkoff (Russia). — The information of a method to study the flood.

1° The problem of establishing the relation between surface and subterranean waters is dealt in the reports submitted to the Congress either from a general standpoint or in a form of local cases of certain rivers.

2° There is no mentioning about methods of study this question for large unsurveyed territories, particularly when it is necessary to pronosticate the hydrological conditions for navigation and irrigation purposes having no long lasting observations.

3° Such a study must be preceeded by a qualitative exploration of the phenomena in order to fix the relative importance of different factors. This exploration can be performed in a way of collecting a great number of observations, taken even without instruments but giving a relative characteristic of the phenomena in all the factors in their relative meaning.

(1) Engineering News Record, vol. LXXXIX, p. 105.

4° An exploration of this kind was undertaken by the Russian Academy of Sciences in 1908 after the disastrous flood of the river Moscow, and embraces the most important event in the life of Russian rivers — the flood stage of spring.

These investigations are without interruption continued being carried out by the Hydrological Institute of Russia, which is founded at the Russian Academy of Sciences as a Central Scientific Institution for water explorations.

5° As a result of data gathered by the study mentioned above we have the possibility to represent the scheme of the flood itself and all its factors in their relative meaning. This scheme gives : a) the relative characteristic of single years without long time observations; b) data for estimating the local relative importance of different factors and the organization of the constant observations of the most important of them ; c) data for pronosticating the hydrological and particularly navigation and irrigation conditions.

6° Nowadays this method is spread by the Hydrographical Institute of Russia on the other stages of rivers, on the regime of the subterranean waters, lakes, etc.

7° There is no mention of the observations on constant points and stations, executed by Institutes or other establishments in Russia : there are many printed works relating to it.

8° I would give another example of the water returning to the subterranean sheets. At the river Syr-Daria in Turkestan it is established, by comparison of the discharges of the confluents and of main river, that it flows into the river near the cliffy bar of Zaporojsk some underground water. This flow raises the river discharge up to 1500 cu. sec., i. e. 15 % of the whole amount, and is produced by the percolation of irrigated water from all the Kerghana into the subsoil sheets. The chemical properties of the river water are therewith sharply modified, after running together river and subterranean water, the contents of salt residue (after evaporation) increases up to 30 %, which gives to the salinity of underground water as $\frac{1.3}{0.15} = 8$ times higher than of the riverwater. Thus in southern countries, where there is often danger of salining, it is not always agreable to receive some surplus of water as the remains of irrigated water.

M. Verloren van Themaat. — Mr. Chairman, Gentlemen, I wish to endorse the suggestion of Mr. Sandeman to come to an understanding on a uniform way of recording the necessary data regarding runoff and rainfall. I want to draw attention to some data, which, as far as I am aware, have not been mentioned in the reports and are of interest to engineers. The first is the length of time of the rainfall that is correlated with the runoff. On this point for our Holland polders and small watersheds our authorities gave a period of 5 to 10 days as being correlated to the runoff. For most of our polders this may be right, but sometimes it is not. I had an opportunity recently to study this matter and found for a watershed of about 200.000 acres that the runoff was much more correlated to the rainfall of the last 30 to 40 days than to the rainfall of the last 5 to 10 days. So the maximum runoff would be a certain fraction of the maximum rainfall in 30 to 40 days and be much lower than computed otherwise. Comparative information on this point may in my opinion be of interest to engineers.

The second point which I want to recommend for uniform recording is the characteristic of maximum rainfall for different localities. In all our studies of runoff, maximum runoff is always of great importance, so maximum rainfall is of great importance too. For this latter the best way of recording in my opinion is that given by Mr. C. E. Grunsby in a very interesting paper for the American Society of Civil Engineers, in 1921, viz. by a graph placing on one axis the length of the period of maximum rainfall and on the other the average maximum rainfall per day. The curve so found is typical for different localities and gives information of much importance for maximum runoff.

Referring to what Mr. Sandeman said about advisability of having an institution for recording data on rainfall, etc., I may draw your attention to a new institution we have in Holland, the Directory of Drainage (Rijksbureau voor Ontwatering). I think that bureau might collect those data for engineering purposes, which up till now have been collected from a meteorological point of view.

In conclusion some runoff data for our pumping plants may interest you. With an average rainfall of 680 $^{m}/_{m}$ per year the

water pumped out is a sheet of about 100 $^{m}/^{m}$ and the pumping capacity required 0.6—1.2 L. an average of 1.0 L. per sec per H. A.

Mr. Ben Howorth. — The question of water flow in rivers in Great Britain is principally of interest to Engineers dealing with water supplies to large cities and communities. It has a limited interest to Canal Engineers as the future of canals and navigable river traffic development in this country appears to be more in and about the large ports and in the lower reaches of the rivers where water is usually abundant. The development of through routes across the country is greatly hampered by the shortage of water in the higher reaches but the works necessary to improve these conditions would prove far too costly even to be economically carried out.

How important the water supply question for drinking purposes is, is shewn by the statement of Lord Desborough that in one day recently the population of London drank the whole flow of the River Thames ! What will happen when this country follows the United States and introduces « Prohibition » is a matter for grave reflection !

Members of the Congress are reminded that there is in the Library of the Institution of Civil Engineers a book on Hydrology by Mr. Nathaniel Beardmore published some 70 years ago, in which the author studies the questions dealt with in this report. He collected data from many countries, Great Britain, Ireland, France, Italy, etc., for about the period 1850 to 1860. On the question of the amount of runoff from a watershed compared to the rainfall he gives varying figures from one half to two thirds. In the case of one river with which he was intimately concerned he gives a figure of barely one quarter of the rainfall passing as visible supply.

The point to note is that in this latter case the records which have been kept for the last fifty years confirm almost exactly this figure and perhaps his figures for the other rivers of Western Europe will be found just as accurate.

The quantity quoted above, of one quarter of the rainfall only passing off as visible supply, is for a river having a large upland

gathering ground of chalk and the water which finds its way into the chalk provides a vast underground reservoir for supplies and also provides a certain amount of water from springs which keeps the flow of the river more constant than would otherwise be the case. The curves of rainfall and discharge for such a river shew a very distinct lagging behind of the curve of discharge compared with that of the curve of rainfall.

The quantity of water used for navigation in this country is in several cases fixed by Acts of Parliament passed many years ago when the question of allotment of supplies first began to be a serious problem and such quantities have mostly sufficed, perhaps only because generally traffic has not increased.

In the text of the above quoted book, the Author states that « he is particularly gratified at the immediate assiduity with which scientific gentlemen in St. Petersburg, Rome, Naples, Madrid, Brussels, etc., have responded to applications for information. » The International Post Office arrangements now render correspondence easy and cheap, where formerly it was practically impossible to procure prompt returns. This was in 1860 and it is easy to imagine the extreme gratification which Mr. Beardmore would have expressed if he could have seen such a gathering from all over the worlds as this International Congress of today.

M. Müller (in French). — Mr. President, Gentlemen,

The first communication contains in my opinion, two distinct questions of which we have discussed the text at the Permanent Commission. The latter wished at first to divide the two questions, but it was then decided to leave them under the form of a single communication.

It is then natural that the programme of the first communication has been treated by the Reporters from two points of view, that is to say : 1°) from the hydrological point of view which indicates and registers the necessary data for the estimation of the discharge of the stream (precipitation, drainage and their mutual relation), and 2°) from the hydrotechnic point of view which seeks the technical means of utilizing the riches of the water in the most economical manner.

From the first point of view, the question takes the character

of a problem of pure hydrology. The excellent reports of Messrs. Mead, Dienert, Salter, Reed and Wallen, deal with this question quite systematically, and in a very clear manner.

The primordial importance of the hydrological data must be reconized with a view to the solution of the question of hydraulic economy. But what interests navigation still more, is the hydrotechnical point of view, that is the question of mixed canals.

On this subject, we have been expecting as our french Colleagues have already mentioned, the reports on the mixed canals in operation. They told us that the Italian engineers would present us with an account of their experiments and reports relating to them. But in the other reports which we have received, this question is not treated (except the french report ; it is an unique case). I would like to speak from this practical point of view and mention certain experiments which may interest us from a technical standpoint, and which are dealt with by the Czechoslovakian engineers, Messrs Kobza and Hengenius. It seems to me that they show us the way by which we can succeed in conciliating the different interests who demand the use of the water, and in the first place those of navigation and agriculture.

The said report consider the case of a canalized river : it is the middle Elbe which can be assimilated to a mixed canal, as admitted to the Permanent Commission in drawing up the text of the Communications. The basin of the middle Elbe is very fertile and it must be opened to navigation by the canalization of the river, which is already in execution.

For practical needs, the conditions and the possibilities of accumulation or storage of water in the respective basins of the river, most be known because these are the conditions which characterize the basin and its discharge.

The accumulation can take place on the surface or the sub-soil. In their natural state, the streams present different capacities in what concern the storage, a circumstance which several reporters also mention. Very often it is possible to increase this capacity by artificial means.

The conditions of accumulation can be modified by a regulation of a stream, as much for the surface as for the sub-soil, and in consequence, the volume can also be changed. As to the means

of managing and controling the discharge of our rivers in Czechoslovakia, we must first of all, as I said during the discussion on the first question, regulate their flow and make it uniform.

That is possible when surface and sub-soil reservoirs are used.

The surface reservoirs were dealt with in the report distributed.

As regard the accumulation of subterranean water, in studying this question, for the Elbe, we have succeeded in finding a method which seems to me likely to satisfy the different interests on the canalized rivers : after this method the water in the river-side lands can be accumulated, the water can be utilized for the production of power on the high falls, and satisfy at the same time the needs of agriculture in the following manner :

a) by warping by the muddy water ;

b) by infiltration under-ground during the period of vegetation;

c) by drainage and drying up of the land during the winter season, and eventually by irrigation of the land by means of drains, if there is occasion, in the portions where the infiltration underground is not sufficient.

This solution can conciliate the diverse interests, often opposed to one another, that of navigation and agriculture.

In my opinion, there only remains for the completion of the study of this question, a series of practical experiments to be undertaken for the purpose of procuring the necessary data and which are more precise, with a view to estimating the range of the variations of the level of the subterranean water in the river-side lands and the influence of these variations on tillage and the conditions of the flow, and to determine the loss of water.

Mr. Criffiths. — Please forgive my for again trespassing on your kindness. I was very interested indeed to hear what Mr. Sandeman said. Under an Act of Parliament, the Thames Conservancy are under a statutory obligation to keep such records as he suggests I do not want to be too egotistical, but I do think we have the most complete records in this respect of any authority in England, if not in the world. We keep a very complete record of rainfalls at stations dotted all over the Thames watershed at various levels and these rainfall returns are submitted to us daily.

I have a staff which calculates daily the amount of water which passes through our lowermost weir which is Teddington. They arrive at the results by means of a formula, but we employ automatic recorders as suggested by Señor Bellacasa. Moreover these automatic recorders, are connected with the Metropolitan Water Board pumping station so they can always adjust their pumping to conform with the quantity of water that is passing over the weir. Without these complete records, such as have been suggested by everyone I think that has spoken, we could not control or regulate the supply of water for London ; nor could we have agreed and fixed on a definite quantity of water as being available for the supply of London for the next 50 years. At the same time through these records we have been able to determine the actual reservoir construction that was necessary in order to supply an ever increasing quantity of water for the increasing population. Again we have found these records of the greatest service in so much that I can regulate my river. I have 47 weirs and I can regulate the flow of this river through my records just like playing a piano. In fact I had to do that during the drought of 1921. I had the various pumping stations, some pumping 9,000,000 gallons a day, some 15,000,000 and so on in the various reaches, and I was able to sit at my telephone and not only regulate the weirs, but I kept all the pumping stations going and balanced the flow from beginning to end. I got very sick of it ; I will tell you that frankly, because I had to sit tight during the whole of July, and the best part of August and could not leave the place. I do not tell you this in any way in order to be egotistical, but with a view to impressing you as to the great boon and the great necessity it is for such records to be kept. With regard to the question of flow off, we have for instance a very valuable flow on the Thames varying from 20,000,000,000 gallons in one day of 24 hours, to 200,000,000 gallons in one day of 24 hours ; and our percentage of run off varies naturally between the summer months, April to September, and the Winter months, October to March. In the first case the average percentage flowing off over the last 36 years is 21,5 % of the total rainfall over the Thames Basin. In the Winter it is 40,3 Now that sort of record naturally tells you what is going to happen with your floods and so on, and you can

draw and regulate your weirs accordingly. I hope to write and give you all this in detail, for your help, because the experience of one man always helps others; and I hope I shall do it before the next Congress, so that you can have as much information about these records as I have. In addition to that, I am tabulating many of the wells in the watershed. We found out in the drought that in the higher chalk areas the fall in the well levels was as much as 65 feet. I am now tabulating them in districts throughout the watershed, and I shall keep a permanent record of the rise and fall. In another ten years I think I shall be able to give you not only the rise and fall there, but the average rate of flow of the underground water.

We know by experience that we get the rainfall in one section of the Thames watershed into the river from four to six months after it has fallen. Now that sort of information is bound to be of great advantage to all of you good people in your different localities. That is the sort of information which I think we ought to get, and I very heartily support the suggestion that we shall try to get together an International Committee with a view to co-ordinating our methods as far as possible, each one working on the experience of the others, and I shall be very glad indeed to support the resolutions which have been suggested by Mr. Sandeman.

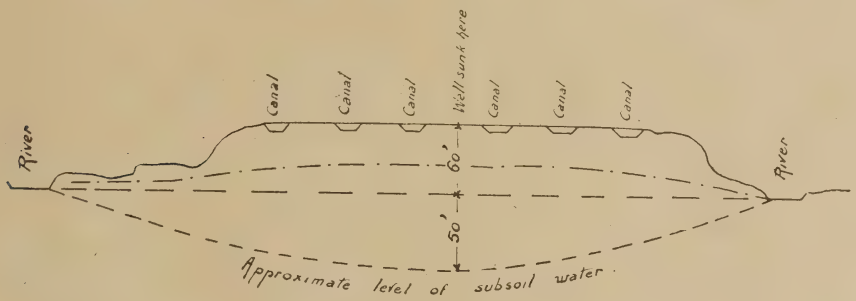
The Chairman. — If there is no one else who wishes to speak, it occurred to me that perhaps it might interest you if I just continued for a moment the remarks which I made before with reference to the great loss of water on our irrigation systems in India, where, as I said, we calculate that we do not get more than 25 per cent of the water that we bring in at the head of the canal actually on to the fields.

You may have wondered what becomes of the water, where it goes to, and I would like just to show you the cross section of one of the tracts of country which we developed on the Chenab canal.

The Chenab canal is one of the largest artificial irrigation systems I suppose in the world. It discharges anything from 12,000 cubic feet to 15,000 cubic feet a second. It has a bottom

width of 250 feet and runs anything from 10 to 12 feet of water. So that it is a very considerable volume. 75 % of that is being lost. It is perfectly obvious that that water has got to go somewhere. The canal commands about 3,600,000 acres of land ; that is about 5,600 square miles of country. This country is mainly, or was mainly desert land. There was no life in it when we first took the canal there. There was nothing but snakes, field mice, and lizards. There were no birds or deer. The only things that could live there practically were camels. There was splendid grazing when there was any rain. There was never more than five inches of rain in the year, and very often there were three of four years continuously without any rain at all.

In years of good rain there was good grass. There was no drinking water. I have myself sent 20 to 25 miles for drinking water to cook with ; it had to come on camel back in leather bags and when I got it, it was often brackish. (The Speaker illustrated his remarks by drawing on the blackboard).



The sketch shows the section of the tract of country between two rivers. Before irrigation was introduced the sub-soil water level was approximately as shown in dotted line and the middle of the tract was 50 feet below the level of the rivers so that they really filtered into it. Before the canals were opened a well was sunk in the middle of the tract and we had to go 110 feet to water level. Since the canals were opened the subsoil water has risen as shown in dot and dark line showing where some of the loss in the canals has gone and the subsoil water drains into the rivers.

Gentlemen, I think I may now put before you again the resolution which I think we might pass — or at any rate I will submit them

for your consideration 1) *That an international Committee be set up, a) for the purpose of compiling records relating to this subject, which have already been obtained* — such for instance I would suggest, as the records which the Thames Conservancy would be able to give us. Elsewhere in the country there may be other records, and in all your countries you probably have some records from which some useful information might be obtained , *b) To consider and decide upon the best methods to be employed in obtaining reliable information on this question in the future with the object of making recommendations for the adoption of uniform methods of measurement and for the collection of records.*

I think the first point would be to ask you to consider whether you agree that the International Committee could be set up. If you agree to that, then we can afterwards take the two subjects into which it is divided.

The Resolution that an International Committee should be set up was put to the Meeting and carried unanimously.

The Chairman. — Then the object of the Meeting would be first of all to compile records relating to the subject which have been already collected in various countries and by various communities.

M. Müller (in French). — Mr. President,

I should like to propose the extension of this task concerning navigation, that is to say, that it should also include a resolution relating to the reading of the scales and the pronostics of low water in the rivers. We have a similar service of pronostics on the Elbe in Bohemia, service organized since 1875, and which is working very well as regards the indication of floods ; but it also gives good results for navigation. Pronostics are made daily on the height of water to be reached in certain stations on the Elbe (i. e. Melnik, Usti, Dresden, Magdeburg) for 12, 24, 48 hours beforehand, by means of an empiric calculation based on the reading of the hydrometric scales located on the upper course and on the affluents of the Elbe. Navigation draws considerable profit from it.

It is a service similar to that organized for the basin of the

Seine by M. Belgrand for the purpose of protecting Paris from unexpected floods.

This Committee would also find the study of this question very useful, because it interests navigation and is connected with the study of precipitations and discharges.

M. Dienert (in French). — I wish to give my support to what the Delegate of Czechoslovakia has just said. There exists in the Seine basin a hydrometric service which is well organized. It enables us to foresee the level which the floods are going to reach at the time of floods. It is above all a service of information for navigation, and at the same time it registers the moment when certain floods are going to occur. There exist in France a certain number of water-gauge stations, not only for determining the importance of the risings, but also for ascertaining the discharge of rivers. It is especially the latter which should be developped. All this information should be centralized. There are methods which have given results and it is important not to abandon them.

M. Armand (in French). — We must not go too much into details about the mission entrusted to the international committee. It would be preferable in order to satisfy Messrs Müller and Dienert to put a preamble before the suggestion.

We could then say « Considering that the knowledge of the regime of waters is a question very interesting both for, etc. »

M. Müller agrees to this proposal.

(The Chairman in consultation with several members then drew up a form of Resolution.)

The Chairman. — Gentlemen, I hope we have come to an agreed conclusion upon this subject. It is now suggested that what we should submit to the General Congress is : *Considering the impertance of the acquisition of complete information of the regime of both surface and subterranean water for navigable rivers and canals*

and mixed canals, power, agricultural, and all other interests, this Section of the Congress is of opinion that it is desirable that :

1. *An International Committee be set up :* a) *for the purpose of compiling the records relating to the subject which have already been obtained;* b) *To consider and decide on the best methods to be employed in obtaining reliable information on these subjects in the future with the object of making recommendations for the adoption of methods as uniform as possible of measurement and for the collection of records.*

2. *That in the meantime the authorities of all countries should be urged to study the question with a view to arriving at the best method of procedure.*

May I put that to the Meeting as a whole or should I put it in sections? It seems to me that the whole is really one subject, and I would therefore suggest if you agree that we may take one vote on the whole Resolution.

The Conclusion was adopted unanimously).

The Chairman. — Before adjourn this Meeting for lunch I should like to take cognisance of the death of Mr. de Carle S. Salter, Superintendent of the British Rainfall Association who contributed paper n° 17 that we have had under consideration today. I regret extremely to announce that he died quite recently. I have only just this minute heard of it. I do not personnally know Mr. Salter, but I am quite sure that you will all join with me in condolences with any relatives that he leaves, and regret that he was not with us in our discussion

M. Müller (in French). — Concerning the resolutions to be adopted on the subject of the constitution of the committee, I should like to know if the members will be chosen among the delegates who attend the present Congress.

The Chairman. — I think if I understand aright, that must depend entirely on the General Council; it has nothing to do with this Section of the Congress. We can only make a recommen-

dation to the General Council, and it is for them to decide what the constitution of the Committee will be and to take up the matter internationally.

— The Meeting adjourned at 12.45 p. m.

FIRST SECTION

(Inland Navigation)

SIXTH MEETING

Thursday, July 5th, 1923 (afternoon)

Mr. SYDNEY PRESTON, C.I.E., C.B.E., in the chair.

The Meeting is called to order at 2.30 p. m.

The Chairman : Gentlemen, in the regrettable absence of Mr. Eneborg, General Reporter on the subject **Unification of statistics of inland navigation with a view to facilitating the comparison of the results of the working of navigable waterways in various countries,** M. Fröman, Chief of Division, Royal Board of Waterways, Sweden, has volunteered to read his paper, or at any rate, the conclusions, and to add a few remarks.

This communication has been dealt with by Messrs. Grove G. Huebner (U. S. A.), de Kerviler (France), Berni (Italy), Claessens (Holland), Eneborg (Sweden), Partl (Czechoslovakia).

Mr. K. A. Fröman. — Mr. Chairman and Gentlemen, it really is very much to be regretted that the General Reporter, Dr Eneborg has been prevented from attending the Congress. As, under prevailing conditions I have been asked to read this report, I think I can limit myself chiefly to quoting certain substantial parts of the general report. When Dr. Eneborg made out that report not all the complete reports from different countries were available. But these reports, as far as I have been able to find out, do not in any way contradict the conclusions recommended by Dr. Ene-

borg. In those reports it is proposed to submit further questions relating to statistics of inland navigation, to a special Committee. All reporters seem to agree that it is very desirable to get an international standard of statistics in this respect. I will now, with your permission, Mr. Chairman, just read some parts in the latter part of Mr. Eneborg's report and most respectfully comment upon it.

Mr. Eneborg first states that the international statistics on inland navigation might not include more than data relating to the traffic, especially as it is desirable to get as many countries as possible to analyse such statistics-countries which previously have had no statistics on the subject.

Then he says what data relating to traffic ought to be given in the first instance. The list that navigation statistics can be expected to comprise is a statement of the number and tonnage of vessels which have passed on the waterway and corresponding data as to the vessels which arrive at or depart from harbours with inland channels. It is often — though not always — of interest to know the direction of the channel traffic up or down. It is also interesting for the different authorities to know whether the vessels are running in direct or indirect trade. For entries outward it would therefore be indicated if the harbour is the starting point and for entries inward, if the harbour which is being entered is the last port of destination.

(The speaker then reads the report.)

Now, Mr. Eneborg does not say anything about the form of the Committee which he proposes, so I will just move a kind of amendment to this conclusion : « *The Congress submits to the Permanent Commission of the International Association of Navigation Congresses to appoint the said special Committee and to draw up the work of the special committee which the Permanent Commission may find necessary.* »

The Chairman. — Gentlemen, it strikes me in reading this paper that this is an extremely thorny subject. I cannot speak personally because I have never been in charge of any of the navigation canals; but as Chairman of the Canal Control Committee for three

years during the war, I had some experience because we had to get and keep statistics; and really and truly I think we might practically say they were valueless. I can give you an instance of that. There was one series of canals which consisted of three short canals. They had originally been constructed by separate companies, but they were being administrated by one set of Directors with one Managing Director, but those three companies had still been kept quite separate and they submitted all their statistics separately. So that suppose 2,000 tons went down one canal, then it passed on to the next canal, and finally to the third; each of these calculated that 2,000 tons passed; so that after going through the whole of the three it came up to the Canal Control as 6,000 tons. If this traffic then passed on to another canal which might take it 100 miles, it was again counted as 2,000 tons. So that the statistics that we got were really of practically no use at all, and I believe that that system is still going on. Thus, as far as I know the present statistics that we get are not of very much value; but I see the Manager of one of the English canals here today and I have no doubt he will be able to enlighten us a little on the subject. There is one reason which makes me think this is rather a thorny question because I see it is one which has been under consideration of the International Congress on a good many occasions. Thus the Second Congress in 1886 concluded that it was most desirable that statistics concerning inland waterways should be most complete and drawn up in a practical manner. Again in the third Congress in 1888 they outlined a programme and appointed an International Statistics Committee to prepare recommendations; and again in the 4th Congress of 1890 they considered the report of the Committee and recommended the adoption by several Governments of a code of statistical principles relating to inland navigation. Well, that is 32 years ago, and so far this paper does not show there has been any outcome of that. I think it would have been of interest if the General Reporter, Mr. Eneborg, had in referring to the recommendations of the Congress of 1890 stated what the recommendations were. They are referred to in paper n° 23 in the following terms: « That the best basis for international statistics of inland navigation is that made by the decision of the Fourth

International Congress of Navigation in 1890 »; but it is left there; it does not say what those recommendations were. I think it might have been helpful if they had been briefly detailed.

(At this point information was given to the Chairman.)

With reference to the remarks that I made just now, it has been now pointed out to me that the precis or the abstracts of the recommendations of the Congress in 1890 are detailed on page 3, paragraph 2, of the General Report, and the recommendations were as follows :

« The statistics should comprise first, statistics of navigable » waterways. second, statistics of boats; third, statistics of the » traffic; and fourth, statistics of the accidents. »

I have not been able personally to read all these different papers, or to look up the Report, but I am glad to be able to make the above correction.

M. Popesco (in French). — Mr. President, Gentlemen,

The question of statistics of inland navigation takes on an extraordinary importance from the point of view of the working of navigable waterways. We approve the resolution of the Reporter General concerning the formation of a special Committee. This Committee must draw inspiration from existing works to be able to accomplish its task.

At the Conference of Barcelona, 48 Countries presented reports concerning navigable waterways.

I propose that our Congress express the suggestion that this Committee should be constituted as soon as possible. It would have to study the very important matter which is to be found at the League of Nations and which consists of very important reports presented by all the Countries.

I believe that the study of these reports will greatly facilitate its task.

M. Montarroyos (in French). — Mr. President, Gentlemen,

The Commission of Communications and Transport of the League of Nations is very pleased to be able to contribute all it

can to the success of this Committee, to which we attach all the importance it merits, I am pleased to find that in the name of the Commission, they have cited the League of Nations as being able to facilitate the results which we contemplate, I see, with satisfaction, that our Reporter General, in his Paper also considers the question of guaging. This question of guaging is precisely one of the corner-stones of the result of statistics.

I shall remind the Congress that we have already worked in this direction and that our Commission could perhaps contribute to the work of the Special Committee.

It is especially to assure you of the kind intentions of our Commission that I have taken the liberty of drawing your attention for a few minutes.

Mr. Clarkson. — Mr. President, Gentlemen.

The question of statistics as the President has said, is undoubtedly a thorny one.

As far as the Regent's Canal is concerned, we tabulate our statistics in the following manner. Barges that enter the canal generally carry one kind of cargo, such as coal, ice, wood. Therefore, it is easy to tabulate those particular cargoes. But certain canal boats also carry cargoes which are made up of many articles. These boats are simply recorded as carrying miscellaneous goods. We have a system on the Regent's Canal that as soon as a barge enters our most important lock, at Commercial Road, Limehouse, the measurement of the barge above water is taken at four points; two at the head, and two at the stern. For every barge that so enters we have a card; on that card is recorded its name and the name of its owner. Each time the barge enters the canal these is entered upon the card, the date it enters the canal, the average of the dry inches measured, the declared lading of the barge, and its destination. This card,in time, becomes a gauge as to the weight for nearly every class of goods that the barge carries. We also have a system by which the trade of the canal is further systematised. For every kind of goods carried a card is prepared, such as for coal, on which card the points of origin and destination and the weight and toll are recorded. We

are thus able to ascertain easily what traffic is passing between any particular points.

With regard to the difficulty mentioned by our President, namely, the cumulative traffic passing over many canals, I think that can be avoided if every canal company, whenever a barge or a boat comes off another navigation, discovered its point of origin, and then separated that particular traffic from the traffic which originates and ends on their canal.

Every barge that proceeds along the Regent's Canal has a numbered permit so that we have merely to look at the numbers of the permits issued, to find out how many barges have passed along the navigation during a year or any part of a year.

We have also a system on the Regent's Canal by which, first of all, all the tons and tolls represented by the permits issued are added up each calender month, and then the whole is re-abstracted into the various goods carried. These are also totalled up and the totals have to agree with the totals of the tons and tolls represented by the permits issued. This abstract of the goods carried is a very fine check on the tons and tolls represented by the permits issued. I think, from these card systems, any information that is wanted at any particular moment can be obtained quickly and accurately.

The more care one exercices in arriving at statistics, the more valuable they become.

Colonel Hansen. — Mr. Chairman and Gentleman.

I think we are all agreed that the statistics of inland navigation are of the greatest importance. The Chairman has said that the Resolutions of the Manchester and former Congresses have not had any results, but I think the Committee have not been formed, or that the Committee have fallen asleep.

With that good organisation that our Navigation Congress has at present I am convinced that there will be better results, I beg to join in the conclusions of the General Reporter and I beg to propose that the Executive Bureau may be asked to invite the countries who have delivered reports on this question to nominate members to this committee. Of course, other Nations may nominate members if they wish, but I think it is a good thing not

to have too many members on the Committee. A Committee with few Members will work more easily than a Committee of many Members.

M. Millot (in French). — Mr. President, Gentlemen.

The statistics present a very great interest not only for the Administrations, but also for those using the navigable waterways. Now, at present, they are drawn up in a way which is too official.

I ask the Congress to express the suggestion that the Committee charged with the statistics take into consideration, in their study, the desires of those using the navigable waterways.

I propose, in consequence, to add to the conclusions of the Reporter General, after the passage « *That a special committee be appointed to draw up the questionnaire for this inquiry* » :

« That the statistics be not drawn up solely from an administrative point of view, but also from the standpoint of the utilization of their information by trade and industry ».

« That, in consequence, the Committee take into consideration, » in its work the desiderata and needs of the users of navigation. »

M. Müller (in French). — Mr. President, Gentlemen.

I should like first to inform you of the great satisfaction I felt when I read the General Report of Mr. Eneborg, because it answers entirely to my views; I agree especially on this fact that it is not necessary to unify the statistics too much or too rapidly. It is now more than thirty years ago that the Fourth International Congress dealt with this question at Manchester.

Many resolutions were then adopted asking for numerous and detailed data; but the results up to now have been practically nul, according to the proverb : « Grap all, lose all ».

Such a state of things must be avoided this time; that is why I also agree with the Reporter General that the procedure should not be hurried, and to consider myself satisfied if an improvement of the present conditions could be realized on the most important points.

I believe that everybody recognizes the necessity of statistics for inland navigation and their importance for international com-

mercial relations. But at the same time it must be recognized that the utilization of these data render a certain uniformity desirable.

Until now, it was the point of view of the customs which fixed on the frontiers the principles and the form of the statistics to be applied. Now they have also to serve for other purposes, as for instance, studies and measures to be taken, of a technical commercial and nautical order. We must not even forget that they are eventually necessary to reasonably establish the taxes of navigation for as much as the latter be admitted by the treaties of the different countries. On certain navigable waterways, for instance on the Rhine, statistics have existed for a long time and are to a certain degree uniform, supplied by six states. But these statistics are not the kind adopted by several reporters who recommend statistics far too detailed.

On other waterways, they do not exist, or only partly and are of a dissimilar character.

On the Danube, you have seven States: there are some who have hardly any statistics and others who have some satisfactory enough, but whose basis is very different.

I believe it is difficult and even useless to desire the complete unification of the statistics. On this subject we must share the opinion of the Reporter General that the unification must be proceeded with gradually, and I add, that we must begin with neighbouring riverside countries on a single watercourse. If the statistics could be unified at least in a certain measure on the same waterway, for instance on the Danube, it would be already an excellent thing. Later, we might think of those of the various adjoining basins.

As to the data to be supplied by the statistics, the report names three categories as the most important, namely :

1. The conditions of the navigable waterways;
2. The inland small boat service;
3. The traffic.

Without wishing to ignore the importance of the first category, I should content myself at first, with the other two, in granting the first place to traffic statistics, but limited to figures which are really of international interest.

Concerning the establishment of a special Committee, I agree. Only I take the liberty of reminding you that there are still other international institutions which have to deal with this question, that is to say the International Fluvial Commissions. I support the proposition of the Reporter General with the amendment of Mr. Hansen, because I find that the Committee must not be composed of too many members. When the members are too numerous, it is not always easy to come to a satisfactory result, that is to say, one practically realisable.

Finally, I should like to remark that the Committee might apply to other nations and international Institutions which are interested in these questions.

The Chairman. — Gentlemen, I have no further names of gentlemen wishing to speak, and I desire to say that we have now reached half-past 3, and the Right Hon. the Lord Mayor is giving a reception to the Delegates between 4 and 6 o'clock, so that I think it is desirable that we should bring this section to a close as soon as possible. Mr. Griffiths has been trying to co-ordinate the suggestions that have been made, and it occured to me that as this question has been so thoroughly, I will not say investigated, but has been so often before the General International Commission, it would be sufficient to refer to that, and not to pass resolutions quite in the form of those suggested by the General Reporter, but instead of that, to simply state something like the following :

That this Session desires to emphasise the desirability of obtaining statistics, and desires that the Permanent Commission should take steps to give effect to the Resolutions already expressed in previous Conferences that an International Statistical Committee be appointed with a view to the unification as far as possible of inland navigation statistics.

It seems to me that if we refer back to the previous discussions, all of which are in print and are obtainable, we shall really have done all that is necessary, and perhaps it is better to do that, rather than to start afresh in the terms of the Conclusions of Mr. Eneborg's paper. I put that before you : as to whether that would meet the wishes of this Session, that we should in general terms refer to the previous discussions and decisions which have

been already arrived at with a view to theid being given practical effect to. It is no good having passed Resolutions 30 years ago, if nothing has been done.

Well, Gentlemen, if that meets with your approval, we can quite easily draft something which will simply bring the matter prominently to the notice of the International Commission. I will have that drafted, and if you are agreed to the general terms, really the drafting is merely referring to what has been done previously. If that meets with your approval, I think it will be quite easy for us to put it into terms to be laid before the General Commission.

Mr. Romein. — Is it necessary to mention the special Committee, or would not it be better to leave it altogether to the Permanent Commission to decide by what means the unification desired might best be brought about ?

Colonel Hansen. — I think it is important to have a Committee and not to let it sleep again.

The Chairman. — We can only do that through the League of Nations. A Committee was appointed before, and as Colonel Hansen says, it has become moribund, or has done nothing. I think as we have it worded here it will meet with the approval of this Congress: « *that it is the desire of this Session that the Permanent* » *Commission should take steps to give effect to the Resolutions* » *which have already been passed on various occasions already by* » *previous Congresses, that an International Statistical Committee* » *be appointed, with a view, to the unification as far as possible,* » *of inland navigation statistics* ». I think myself there is no harm in putting that in, and leaving to the General Navigation Congress to decide.

The resolution was carried unanimously.

The Chairman. — Gentlemen, we will see that is worded properly. Before I adjourn this Section I desire to ask you to pass a most hearty vote of thanks to M. Antoine for the more than

able manner in which he has translated the speeches which have been made. I personally am lost in admiration.

I only know the french which I learned 60 years ago while at school. My service has been in India, and, as I have said several times, if we could only carry on these discussions in Hindustani, I should be able to assist you. M. Antoine has had to deal with all sorts of various subjects ; he has taken it all in in a minute, and given it us in a wonderful manner. I would like to propose a most hearty vote of thanks to him, which I hope you will give most cordially.

M. Muhlen, acting Secretary of the First Section, translates in french.

(The vote of thanks was carried by acclamation.)

The Chairman. — To-morrow, the President Lord Desborough will preside at the concluding Meeting when the various Resolutions that have been adopted will be put before the General Meeting of the whole Congress.

The Meeting adjourned at 3.40 p. m.

BUREAU OF THE 2nd SECTION

(Ocean Navigation)

President.

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Sir Ernest **Clover,** Bart., President of the Chamber of Shipping of the United Kingdom.

Vice-Presidents.

BELGIUM

M. **Bouckaert,** Inspecteur Général des Ponts et Chaussées, Directeur Général des Voies Hydrauliques, Brussels.

SPAIN

M. **Maese y Pena,** Inspecteur Général des Routes, Canaux et Ports, Valencia.

UNITED STATES

Captain Frank T. **Chambers,** Civil Engineer Corps, U. S. Navy.

FRANCE

M. **Dreyfus,** Inspecteur Général des Ponts et Chaussées, Paris.

M. **Voisin,** Inspecteur Général des Ponts et Chaussées, Paris.

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Right Hon. Lord **Kylsant,** G.C.M.G.

Sir William H. **Raeburn,** M.P.

ITALY

M. Ludovic **Biondi,** Ingénieur en Chef du Génie Civil (Port de Gênes).

JAPAN

M. S. **Tsuchiya,** Secrétaire du Ministère des Communications.

HOLLAND

M. J. **Nelemans,** Professeur à l'École technique Supérieure de Delft, Delft.

SWEDEN

M. **Hörnell,** Ingénieur Conseil, Membre de l'Académie Royale des Sciences Techniques, Stockholm.

M. **Lundberg,** Commandant au Corps Royal des Ponts et Chaussées, Ingénieur en Chef du Port de Stockholm, Stockholm.

Secretaries

BELGIUM

M. **Bonnet,** Ingénieur en Chef Directeur des Ponts et Chaussées, Antwerp.

SPAIN

M. **Rosende,** Ingénieur en Chef des Routes, Canaux et Ports, Directeur des Travaux du Port de Ceuta.

FRANCE

M. **Barrillon,** Ingénieur en Chef des Ponts et Chaussées, Rouen (Seine-Inférieure).

M. **Marcheix,** Ingénieur des Ponts et Chaussées, Dieppe (Seine-Inférieure).

GREAT BRITAIN

Dr. **Isserlis,** M.A., D.Sc., Statistician to the Chamber of Shipping of the United Kingdom.

Mr. S. D. **Carothers,** A.M.Inst.C.E., Assistant Civil Engineer, The Admiralty.

ITALY

M. Aristide **Luria,** Lieut.-Colonel du Génie, Chargé du Service des Phares au Ministère de la Marine.

HOLLAND

M. P. **van Braam van Vloten,** Ingénieur en Chef du Service technique de l'Eclairage des Côtes, The Hague.

SWEDEN

M. Rolf **von Heidenstam,** Capitaine de Réserve de la Marine Royale Suédoise.

M. **Petterson,** Capitaine au Corps Royal des Ponts et Chaussées, Ingénieur en Chef du Port de Gothenburg, Gothenburg.

SECOND SECTION

(Ocean Navigation)

FIRST MEETING

Monday, July 2nd, 1923 (afternoon)

Sir Ernest GLOVER, Bart., in the chair.

The meeting is called to order at 3 p. m.

The Chairman. — Gentlemen, We had the honour this morning of being welcomed at the opening of the Congress by H. R. H. the **Duke of York,** supplemented by an expression of welcome on the part of **Lord Desborough.** As Chairman of this Section, I should like to second that welcome, and express the hope that in our deliberations here we may be able to evolve something which will be for the benefit not of one nation only but of all the countries here represented.

I should like to say, at the outset, how greatly I appreciate the honour of being invited to occupy the chair at the Meetings of this important section of a very important body—both personally and in my capacity as President of the Chamber of Shipping of the United Kingdom. It gives me great pleasure to be here and to meet you, gentlemen, today.

That ocean navigation to-day is a subject of fundamental importance to all civilised nations is emphasised by the fact that fourteen different maritime nations are represented by the authors of the Reports and Communications which will be put before us.

To this country, cheap and efficient ocean transport is a vital necessity. We in England are dependent on sea carriage for the importation of the greater part of our food and of the raw materials for our manufactures, as well as for the export of the coal and manufactured goods which form part of the payment for our imports. The remainder of the payment, as you know, takes the form of services such as banking and insurance, and particularly the payment of freight and passage money for the carriage across the seas of goods and passengers who make use of our shipping. The inevitable law is that imports must be paid for, if not in bullion then in goods exported, or in services. It is often difficult to trace the exact application of this law to goods and services between any two countries, and in the intricate ramifications of modern world trade it may well be that a parcel of Chinese silk imported by a London merchant is ultimately paid for by the transport of an emigrant from Spain to Brazil.

We have built up a system of foreign trade which enables us to maintain a population of 45,000,000 people on two small islands, entirely on the foundation of ocean transport. A report prepared by a Committee of the Royal Society in 1917 shewed that during the five years before the war over 58 per cent of the energy value contained in the food consumed by our population came from imported foods. Our yearly consumption of cereals was about 5,000,000 tons, of which nearly 4,000,000 tons were imported. To take the two most important articles of food, bread and meat, we may note that of the weekly consumption of cereals — four and a quarter pounds per head of the population — three and one third pounds are imported, and of the weekly consumption of meat — two and one third pounds per head — nearly one pound per head is imported.

Expressed in other words, we in this country eat homegrown bread for only 13 weeks in the year, and imported for the remainder. We eat home-produced meat for 32 weeks in the year, and imported for the remainder. But this is not a final analysis, for much of the home production of meat and milk and wheat depends on the importation of feeding stuffs for stock, including the offals from imported grain, and on the importation of fertilisers.

It may be of interest to enumerate the bulkiest of our imports during 1922:

Food	Millions of Tons
Grain and flour	8.97
Meat (omitting poultry and game)	1.32
Sugar	1.93
Butter, cheese, eggs, tea, coffee, cocoa, etc.	0.78
	13.00
Raw Materials	
Iron Ore	3.47
Cotton	0.75
Wool	0.49
Rubber	0.64
Wood Pulp	0.93
Oil	3.63
	9.91

These are the bulkiest of our imports, and account for about half the total by weight.

I note, in passing, that « **the use of liquid fuel for navigation, and its consequences** » is to be the subject of *a Communication* to this Section. In this connection, it is of interest to see that the weight of the oil imported in 1922 exceeded that of any other raw material, iron ore coming second.

The most important of our exports, of course, is coal. In 1922, over 64,000,000 tons were exported, and, in addition, 18 1/4 million tons were shipped as bunkers for the use of vessels engaged in the foreign trade. No doubt a good deal of the 64,000,000 tons was intended for the supply of coaling stations abroad, or used, in part, by the importing countries for the bunkering of ships at their ports. Another link is thus provided between the development of navigation and the prosperity of this country. These observations are sufficient to remind us of the importance of navigation to this country, and that it is fitting that a Congress such as this should be held here. If such a Congress is not welcome here, where should it be welcome?

The dependence of the world on ocean navigation brings us naturally to the consideration of the factors affecting its cheapness and its efficiency. Those concerned with the provision of facilities ashore and afloat are always aiming at furthering these objectives, and we note that there has gradually developed a great advance on the days when spices from the East were brought overland to our forefathers in London, by caravans, across the Mediterranean by Venetian ships, and again overland to Northern Europe, with the result that these spices (necessary, in the days when winter food supplies consisted of the salted and pickled summer surplus, to render the questionable food palatable) were worth their weight in gold by the time they reached the consumer in Northern Europe.

Today, ocean transport is very much cheaper than road, or even rail carriage. Taking the first week of May as an example, the freight on grain from New York to Liverpool (1 sh. 9 d. a quarter of 480 lbs.) was less than 5 d. per cwt., whilst the railway rate from Liverpool to London for the same article was 1 sh. 4 d. per cwt. and the average price of British corn during the week was 10 sh. 8 d. per cwt. I an afraid, however, that the rate of ocean freight quoted above would not pay the steamer's expenses on the voyage. Today, a pound of frozen mutton is carried from Australia to London and kept frozen for six weeks at a cost of a penny farthing per pound, while the retail butcher charges the suburban housewife for his services in purchasing the mutton at the central markets, cutting it up conveniently and delivering it to her, the sum of fivepence to sixpence.

What, then, are the factors which have contributed to the cheapening of carriage by sea and the possibility of the further development of which must be the object of our considerations?

Steamers must be up to date, utilising the most modern improvements in design; they must be of the size best fitted for their particular trade, and engined so as to be most economical in the use of fuel and of labour. There is always a conflict between economy of running and speed. For a cargo vessel, high speed is of secondary importance compared with lowness of running cost and consequent lowness of freight. The passenger is usually willing to pay more for his passage in proportion to the reduction

of its duration and for him is the large ship, powerfully engined and extravagant in the consumption of fuel. Perishable cargoes also frequently require high speeds, as otherwise the cost of refrigeration for the long voyage is unduly increased.

A second conflict is that between the most suitable size of the ship and the accommodation provided by the likely ports of call or by canals of which use has to be made to reach the destination. Passenger ships on the Atlantic route have developed to a size impracticable on the Suez Canal route to Australia and the East, and are strictly limited in the choice of their terminal ports. Any attempt to develop other ports, for their accommodation would probably be entirely uneconomic.

The economies which may be expected from the use of oil fuel will be discussed at this Congress. The chief economy is probably to be found in the time saved in bunkering and the labour saved in the stokehold, and in the more even production of steam.

The subjects to which you will be asked to devote most of your attention, however, are **the relative advantages of ship equipment and port equipment for loading and discharging ships; mechanical equipment of ports, mechanical handling of freight, loading, discharging and carrying between ships and shore, and so forth.**

The provision of increased accommodation and the increased and improved facilities at the ports involves heavy capital expenditure with consequent charges for interest and sinking fund, as well as repairs and maintenance, leading to a heavy daily charge for standing expenses. These are necessarily reflected in dues on ships and cargoes, and the question will, therefore, arise in most ports as to how far such expenses will be justified by the increased facilities obtained, whether the increased rapidity in the handling of cargoes and in bunkering will prove an economy commensurate with the capital expenditure involved. With regard to our coal exports, particularly, continuity of loading is of the utmost importance, and for this reason the reintroduction of the three-shift system at the ports at the North East coast, and, more recently, in South Wales, is very welcome. The rapidity of loading coal is almost entirely dependent on the shore equipment, and British ports suffer from the smallness of the traditional coal wagon, 8 to 10 tons, as compared with 20, 25 or even 40 tons on American rail-

roads, whilst tips and cranes are, in many cases, antiquated and defective, and railway arrangements for the handling of the trucks frequently leave much to be desired.

When we turn to the problem of accommodation — the depth of basins, the width of entrances and the length of quays — all matters seriously affecting the capital expenditure and the consequential burden of standing charges, we must seriously face the question of whether these should be given preference as compared with the provision of extra facilities for rapid loading and discharging. Size is a matter that particularly affects passengers ships. Tramp ships, which do so great a part of the carrying trade of the world, are necessarily limited in size by shipping possibilities, which, in various parts of the world, are controlled by natural bars or by the port being situated on a river, where draft of water cannot be increased.

Another point to be born in mind is to see that where improved facilities for the actual loading and discharging of cargoes are to be provided, corresponding improvements are possible in the arrangements for sending goods forward for shipment and in their distribution from the point at which the steamer discharges.

Turning to the programme before us, many reports have been prepared in connection with the three questions put down for discussion and the four communications on technical subjects. It will be desirable to adhere as closely as possible to the printed time-table, so as to facilitate the attendance by members who wish to do so at the functions that have been arranged for them. It will be convenient, therefore, if members who wish to take part in the discussion on any particular subject will send in their names beforehand. It is desirable that everyone who wishes to speak should have an opportunity of doing so.

I will now ask Mr. Savile to present his report on the first question « **The accommodation to be provided for ships in connection with the construction of new works at ports in order to satisfy the future dimensions of ships.** » Mr. Savile, I understand, has made a careful examination of all the reports that have been sent in, and will make a report on the subject.

After Mr. Savile has made his report, I will ask Mr. Wilson to

make his report on the *second question*, « **Types of works for berthing ships of great draught in tidal seas.** »

First Question

The accomodation to be provided for ships in connection with the construction of new works at ports in order to satisfy the future dimensions of ships.

This question has been dealt with by Messrs. Bonnet and Urbain (Belgium), von Heidenstam (China), Lorenz (Denmark), Clavel (France), Kirkpatrick, Savile, Wentworth-Sheilds, Biles, Westcott Abell, Foster King, Scott, Gilbert, Gedye, Frech (Great Britain), Luiggi (Italy), Boomsma (Holland), Hörnell (Sweden), Captain Chambers (U. S. A.).

Mr. Savile. — My chief trouble in the preparation of this report has arisen from what I may call an « *embarras de richesse* », there have been 18 papers on this question from 9 different countries, and, as my report had to be confined to a pamphlet not exceeding 28 pages, you can quite imagine the difficulty I have had in giving anything like an adequate summary of the subject or of the different papers which have been sent in. I should like therefore, in the first place, to apologise to the gentlemen who have contributed these papers for the very inadequate manner in which I have had to summarise their contributions. It has not been my fault, but was due to force of circumstances.

I will, to start with, give a very short résumé of the various papers, so as to indicate their general drift. Such a summary is really given in the first two pages of my report.

The first paper, n° 26, by MM. Bonnet and Urbain, of Belgium, is a description of extensions of the port of Antwerp now being carried out, and a detailed account of the Kruisschans Lock.

With regard to the second paper, n° 29, I could not make a report on it, because it was not received until after my report had to be sent in. It is by Mr. von Heidenstam, Engineer in Chief, Wangpoo Conservancy Board, Shanghaï, China, and deals with the development of the Wangpoo river, on which is situated Shanghai, at a distance of 15 miles from the mouth. The Author states

the Whangpoo had, in 1918, a navigable through depth 24 feet, and might be regarded as a ship canal, with Shanghai harbour as the port of this canal, a typical tidal river harbour of a length of about 10 miles, having a total river frontage of 20 miles, occupied by pile wharves, pontoons, bundings without wharves or pontoons and natural banks or creeks, with varying depths from 12 up to 30 feet and over. Since 1918, further improvements to the Whangpoo have been affected by dredging, etc., and the river is now 26 feet deep over its entire length from Shanghai to Woosung, over a width from 1,000 to 400 feet. The 1922 programme contemplates a depth of 30 feet at lowest low water. It is shown that, when this is carried out, the problem of access to Shanghai still remains, as this is over the Fairy Flats in the Yangtze Estuary, with only 16 feet available at lowest low water. It is pointed out that Shanghai, as the commercial gateway to Central China, has an extremely favourable position as the natural point of distribution for the traffic of an immense area, and the necessity of an investigation of the technical-economical problem involved in a further development of the Shanghai harbour is emphasised. A Committee of consulting Engineers was appointed to consider and report on the further harbour-development possibilities at Shangai, and a summary of the recommendations of this Committee is given in this report. I have given rather a lengthy summary of this paper, because there is nothing about it in my printed General Report.

Report n° 30 is from M. Lorenz, who gives a description of the works undertaken in the extension of the port of Copenhagen, giving detailed plans of the dock and wharf walls which include new features.

The next paper is from the United States, by Captain F. T. Chambers, and indicates that past increases in the size of ships is misleading and has given rise to extravagant ideas as to the future, seeing that the depths of the harbours of the world now set a limit to progress. Captain Chambers further states that the nett, gross and dead-weight capacity of vessels may be taken as 1, 1 1/2, and 2 1/4, and this is a very simple approximate rule which should be very useful. Where wharf space is limited, Captain Chambers recommends that wharf sheds of six or even eight

stories should be erected, and this would be an interesting subject to discuss.

The next paper is from France, by Mr. Clavel, and gives a review of the various considerations arising on the question of improved dock accommodation and the necessity for economy to avoid high dock dues. *He suggests subsidiary estuarine ports to towns situated away from the sea.*

Next comes a series of 10 papers from Great Britain, the first of which, by Sir Cyril Kirkpatrick, states view as to future size of ships and dimensions of locks, docks, wharves and sheds, with particulars of cranes used at London Docks, and he also expresses doubts as to whether the building of monster vessels is in the best interests of the general public. My own paper deals with increase in cost of harbours, locks, docks, wharves, jetties, etc., due to increased draught of ships, and I have endeavoured to prove that the cost of the increase varies approximately as the cube of the depth. Mr. Wentworth-Sheilds gives particulars of depths and lengths of channels, wharves, docks, etc., at Southampton with views as to dimensions for future extensions. In this paper it is shown that the Berengaria has been taken through a dock entrance with about one foot clearance on the sides. I think that is running it about as close as anybody would care to go. Sir John Biles treats of the economic dimensions of ships, and he also advocates a Chair of Shipping. Sir Westcott Abell deals with the British merchant fleet in relation to dock requirements. Table 3 of his paper shows that ships of smaller sizes remain in service for a much longer period than the larger ships. Mr. J. Foster King traces the growth in the dimensions of ships. Mr. King is not content with ships 1,000 or 1,100 feet long, but suggests lengths of 1,400 feet, which I suggest is rather an alarming proposition. I suggest the first ship of that length might called the « Megalomania ». Mr. Adam Scott gives the number of ships of very large tonnage and average tonnage of present ships and size of ships now being built; he also indicates the necessity for economy and the danger of extravagance in harbours. Mr. T. S. Gilbert deals with the importance of depth in approach channels and the extremely long life of wood pile structures in Belfast harbour, and the consequent economy obtained by their use. He advocates the general use of

wood jetties in preference to concrete, on the basis of his experience at Belfast.

Mr. N. G. Gedye deals with the general requirements of docks and harbours to meet the needs of merchant ships of 500 feet long or over, with particular reference to the Palmer Dock (Swansea). Mr. S.A. Frech classifies harbours according to facilities for extension, and considers each class in detail. He advocates systematic development, and suggests that port dues should be graduated and increased with draught. Dr. Luiggi, in the one Italian paper (1) presented deals with the present tendency towards increased draught of ships and makes suggestions as to probable size of future ships for various trades. He gives dimensions of present channels, locks, etc., in Italian harbours and suggested general dimensions for first-class future harbours.

The next paper is from the Netherlands. Mr. Boomsma (2) shows that average tonnage of ships entering largest ports is moderate and that berths of moderate depth can always be used. He indicates the necessity for good lay-out to enable extension and deepening, and advantages of piles over gravity walls for berths, with particulars of proposed extensions and lay-out at Rotterdam. The last paper is from Sweden; Mr. F. C. Hörnell traces rise of port systems with particulars of recent progress in Sweden; he shows that present first class harbours will require to develop equipment and accommodation in the highest degree to enable them to retain their position.

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(1) **Note of the Executive Committee.** — This report says page 3, « When Genoa has its future quays at 12 meters under average sea level it will be the deepest port of the Mediterranean ».

On this subject, it was remarked that Marseilles has possessed for several years quays which have a depth alongside of 12 meters at low-water, and that a quay is under construction which has a depth of 13 meters at low-water.

(2) **Note of the Executive Committee.** — The General Report of Mr. Savile says, page 27 : « Mr Boomsma concludes that a quay wall on pile-work is preferable to a wall on caissons ; he doubts however that the only motive that might eliminate the quay-wall on caissons, and points out..... »

On this Mr. Boomsma pointed out that it could be concluded, from these remarks, that everything considered, the quay-wall on piles is preferable to a wall on caissons, whereas the contrary must be supported. It would then be read :

« Mr. Boomsma concludes that a quay-wall on piles, from the standpoint of the possibility of deepening, is preferable to a wall on caissons ; he doubts however that this sole motive may eliminate the quay-wall on caissons, since this latter is to be preferred for other reasons and points out..... »

Mr. Savile then read that part of his General Report coming under the heading :

General Remarks on Reports

It is submitted that the reports may be grouped under three headings :

Group A. — Five reports dealing with the present and probable future dimensions of ships :

35, 33 (1), (2), (3) and 34 (1).

Group B. — Eight reports dealing with the accommodation to be provided for ships :

31, 35, 36, 37, 30 (bis), 32 (1), (2) and 34 (2).

Group C. — Six reports dealing with new works and with recently constructed docks and harbour works :

28, 30, 32 (3), 34 (2) and (3), 35, 36.

(Some of the reports are placed under more than one heading.)

The following conclusions are put forward for consideration by the Congress.

Conclusions from Group « A ».

1) That although the total number of ships in the world of 1,000 tons and upwards has remained nearly constant in recent years there is and will continue to be an increase in the average tonnage more especially in ships of from 5,000 to 8,000 tons but it is unlikely that there will be any great increase in the size of the largest pre-war ships in the near future.

2) That small vessels of 1,000 tons and under still number about 50 % of the total number of all ships and will for an indefinite time have to be reckoned with in the consideration of port requirements.

3) There is a tendency for economic reasons connected with the cost of running ships, for a general increase in the draught of large ships.

4) The percentage number of vessels of 30 feet draught and over is at present very small but is on the increase and there is little doubt that when the Suez Canal is deepened to 40 feet the per-

centage number above 30 feet draught will be greatly increased and first class ports would do well to afford a depth in their approach channels not much inferior to that of the Suez Canal.

Similar remarks apply to ports served by the Panama Canal which already has a depth of 40 feet.

5) It is generally agreed that the cost of freight decreases as the size of ship increases. The variation of economic length with rate of handling cargo is greater the higher the speed, and for a given speed is greater for the longer voyage while the effect of detention in port is greater for the shorter voyage.

Conclusions from Group « B ».

1) The present depths in the existing harbours and approach channels will set an ever increasing check on further draught of ships by reason of the greatly increasing cost involved in construction and maintenance of deeper harbours and it is doubtful if this factor has been sufficiently allowed for in the prediction of the largest passenger ship dimensions in some of the reports.

2) The difficulties of finding full cargoes, for very large vessels, and the enormous terminal sheds involved in collecting and distributing these cargoes will set a check on increased dimensions of abnormally large cargo carriers as, apart from passenger ships, there is no probability of the trade of the world being eventually carried only in ships of large dimensions.

3) There is a consensus of opinion that increase of draught in all passenger and passenger-cargo ships, and indeed in all high speed ships, has special claims on economic grounds on the cost of running ships, but this claim should be re-examined on the bas s of total outlay involved both on ships and harbours.

4) The equipment for a port in all labour saving devices and in adequate railway connections for the economic collection and delivery of cargo as well as for the rapid and cheap loading and unloading of vessels is of no less importance than berthing accommodation for ships.

5) A first class passenger harbour serving the Atlantic trade will require to provide depths in the neighbourhood of 40 feet at LWOST.

6) A first class harbour receiving the largest cargo passenger ships should provide 35 feet at LWOST at a few tidal berths with the possibility of deepening these to 40 feet in the future.

7) There is a consensus of opinion in favour of the width from cope of wharf wall to sheds of 35 feet or possibly of 40 feet in certain places.

Conclusions from Group « C ».

1) The papers in this group show that whereas provision has been made or is about to be made for draught of 40 feet for Atlantic Liners the provision for cargo vessels is of a much more modest nature.

2) That the estimated cost of any one harbour of a series of harbours of different depths each suitable for a given number of vessels of the same draught varies approximately as the cube of the draught.

3) That as the trade of a port is largely carried in moderate sized ships and only a very small proportion is carried in ships of extreme draught the harbour dues obtained from the latter vessels is quite inadequate on the present basis of charges to pay for the extra cost of the necessary works involved by these few vessels of extreme draught.

General.

The absence of co-ordination between Shipbuilders and Shipowners and Dock Authorities in dock construction is pointed out as a serious defect in port development in the past, and it is suggested that a permanent committee representing all the various interests would be the best means for inaugurating a line of action that should have the effect of preventing the unnecessary expenditure of large sums of money in future construction.

SECOND QUESTION

Types of works for berthing ships of great draught in tidal seas.

This question has been dealt with by Messrs. Bonnet and Braeckman (Belgium); Captain Chambers (U.S.A.). Outrey (France); Wilson and Walmisley (Great Britain); Boomsma (Holland).

Mr. F. C. Wilson. — There have not been very many papers presented on this subject. Messrs. Bonnet and Braeckman describe generally the new works and extensions at the port of Antwerp, and the type of quays to be used. M. Outrey gives some interesting particulars of works which have been carried out in different ports of France. Mr. Wilson gives a few particulars of various types of quay construction suited to different conditions. Mr. Boomsma confines himself chiefly to the consideration of isolated dolphins for berthing vessels out in the open; he does not deal with quays as such at all. Captain Chambers, of the United States, considers this question is merely a corollary of the first question, and does not discuss the matter in detail.

I have understood it was part of the regulations that resolutions had to be put forward on the basis of the opinions expressed in the papers. It has been rather difficult to come to any general conclusions resulting from a concensus of opinion on any particular point, so far as this question is concerned; it is so obvious that the general lay-out of a quay must depend, in the first place, on the locality, and secondly on the character of the trade to be dealt with. One cannot go into details as to all these matters in general conclusions. Having decided on the quay, the nature of the quay-wall depends entirely on the nature of the foundations, which varies in nearly every case. Having decided on the general character of the foundations, different engineers have different methods of dealing with them, of which one is probably just as good as another, and it would be invidious to pick out any particular method.

I have therefore taken a few points which have been referred to in the papers and put them down as a sort of general resolution, as follows :

1° *At least 3 feet of water should be allowed between the bottom of the vessel and the dock bed.*

In the papers, from I foot to 2 meters has been referred to, and it is a very important question, which affects very much the cost of the harbour. In closed docks no doubt the shallower depths should be sufficient, but in open quays, where there may be some movement of the water, and vessels approach under their own steam, greater depth is required.

2. *Where vessels lie alongside quays with a tidal range, fendering should be provided.—These may preferably be loose fenders formed of rope or bundles of willows hung over the face of the quay, or floating fenders.*

This latter is a very common way, nowadays, of providing fenders, and I think it raises an important question on which an interesting discussion might take place, because fendering is a very expensive item, and it has not only to be put in, but maintained.

3. *When the range of tide exceeds 15 feet, it is preferable to provide wet docks entered through lock-gates.*

This is referring, of course, to large vessels. There are open quays with a far greater range of tide than 15 feet, but they are more applicable to small vessels. It would be of interest to hear the views of members as to where the limit should be drawn and locks provided.

4. *Satisfactory means of mooring vessels against the strongest gales should be provided.*

This is referred to in the papers, and is, of course essential.

5. *Wherever possible, continuous quays should be provided. If passengers alone are to be dealt with, or cargo only to a limited extent, continuous quays, though the more convenient, are not essential.*

This, I think is brought out in a good many of the papers. Details and particulars are given somewhat fully as to the method of berthing steamers against dolphins. They are then either connected with the shore by means of transporters or large cranes. This avoids the use of deep quays, and therefore saves considerable expense. At the same time, it is not very convenient, and, where a great deal of cargo has to be dealt with quickly, it is fairly certain that continuous quays are the best, although, of course, they are expensive. I think this is the general conclusion to be drawn from the papers.

6. *The quays should be furnished with mooring bollards, fenders, boat steps, ladders and conduits to carry electric cables, water-mains, etc.*

These, I think, are all obvious. The only point for discussion is with regard to conduits. Many port engineers go in for large

conduits which a man can walk through, and place electric cables, water pipes, telephones, etc., in them. It is very convenient, but it is also expensive. The chief objection, I think, is that, unless you have got a high quay (say 8 to 10 feet above high water) it is difficult to keep these conduits dry; but still, they are strongly advocated, and it would be interesting to hear the views of the members with regard to them.

7. *All terminal ports, or at ports where cargo is dealt with in large quantities, the quays should have direct connection with the main railway system.*

This, I think, is very obvious.

8. *Satisfactory means should be provided for the rapid handling of passengers and cargo.*

9. *Ample width, say 50 feet (16 meters), should be provided between the face of the quay and the sheds or warehouse.*

This has been the subject of considerable discussion, and I find the resolution I have put down here does not agree with Mr. Savile's resolution, that the quay should be 30 to 40 feet wide. In different ports very great variation in the width of quay will be found. Some have very narrow quays, only 8 to 10 feet wide ; these have cranes working straight off the ships, and putting goods straight into the sheds ; at other places they land material out of the ships on to the quays. Personally, I think a good wide quay is a great convenience ; it gives time to sort the material a little before putting it into the sheds, and also forms a sort of reservoir, to receive the cargo while the cranes can go on unloading if there shoud be any delay in getting the goods into the sheds. That saves time, and the ship is not delayed.

10. *The quay surface should be hard and smooth, suitable for wheeled traffic.*

That also should be very obvious, but it is extraordinary how often that rule is broken, and one finds quays which are rough and irregular and add very much to the labour of moving material.

The Chairman. — I now call on Professor Luiggi, Inspector General of Government Civil Engineers, Italy, Professor of Harbour Engineering at the University of Rome, to speak on the

dimensions of harbour works in relation to the ships of the near future.

Prof. Luiggi. — I think the Committee that arranged the programme, which we are beginning to discuss today, deserve the greatest praise, because they have brought forward two questions, the first and second on the list which are of very great importance for harbour engineers, especially at the present time.

Before the war, money was rather plentiful and there was a kind of competition between ship-builders, shipowners and shipping companies, to have the largest ships or the longest ships and so on, and there was also a kind of competition between harbour engineers to build harbours each deeper, wider and more commodious than the last. There was very great competition and money was spent very freely, as it was easy to get. At the present time, however, money is exceedingly tight and I am sure many of those present, who have under their care important harbour works, have to fight a good deal to get sufficient money not only to carry out new works, which is very difficult, but even to keep existing harbours in good repair or to remodel some ports which are too antiquated.

I think the time has come when engineers should agree together and then confer with ship-builders and shipping companies, to see if it is possible to come to an understanding as to the most economical type of ships, in connection with the most economical type of quay wall and depth of water in the different harbours. There has been a great amount of discussion in regard to this question. It reminds me — I am not too young — of a question which was eagerly debated when I was a young engineer, namely, with regard to the gauge of railways — broad gauge, normal gauge, narrow gauge and so on. If anyone goes to Australia, and happens to land at Adelaide, he will go to Melbourne over a gauge of nearly 6 feet. From Melbourne to Sydney he will travel by normal gauge of 4 feet 8 1/2. And if he continues from Sydney to Brisbane, he will find the gauge is about a meter, while further on there is only 2 ft. 6 in. gauge. Something of this happens in regard to harbours. We should like to have all « broad gauge » harbours, so to speak, but the money necessary in order to accom-

plish this, is difficult to find. Before the war we could get it, but now we cannot. If we could all agree on a « normal gauge » we would confer a great boon to harbour Authorities and to the Shipping World.

When I saw that one of the questions to be discussed at this Conference was : « The accomodation to be provided for ships in connection with the construction of new works at ports in order to satisfy the future dimensions of ships », I consulted some of our best Italian ship-builders, and I also talked with some Frenchmen, and I consulted some English builders and shipowners. Of course everyone has different ideas, but broadly they came to this conclusion, that the very large « greyhounds » of the Ocean (which are in everyone's mouth, though few remember that they can all be counted on the fingers of both hands) are in the nature of white elephants. They are a very good advertisement for the Shipping Companies, but a sad burden for the shareholders. As I say, there are very few of these very large ships, especially in the Mediterranean. Only one of them, the « Mauretania », came to the Mediterranean for the first time last winter. Are we to prepare our Mediterranean harbours for ships like that ? It is all very well, but we cannot spent the enormous amount of money required to dredge all these harbours and to prepare quay walls so deep as is required for such enomous boats, that may only come for an occasional trip as compared with a large quantity of smaller ones which call all the year round. As Mr. Savile mentioned, the small ships, which form 50 per cent of the total, carry one-half of the trade of the world, so we must, perhaps, regard this megalomania for building very large ships as a thing of the past. There is now not much money to build on such a colossal scale, and therefore we must be very chary of the dimensions that we adopt for our harbours.

Ship-builders and shipowners believe that there will be a tendency to make cargo boats slightly bigger than in the past. Instead of the 5,000 or 6,000 ton cargo boat, we shall have 8,000 or even 10,000 tons, and occasionally we may go to 15,000 tons, but that seems to be the limit of economic dimensions for the future generation.

Those dimensions do not frighten harbour engineers, because

they can easily deal with ships of that size. In regard to passenger ships there is quite a regression. The 50,000 or 60,000 ton ships, the « ocean greyhounds », seem to be a thing of the past, because as I said, Shipping Companies know that these very fast and large ships are white elephants on their budgets. The 20,000 or 25,000 tons passenger ships seem to be a very good economical size, being sufficiently large to have a comfortable, easy motion on the sea, and to afford sufficient accomodation for passengers, and at the same time, they can be run, if not always full, at any rate with a sufficient number of passengers to make them commercially successful. Ships of 30,000 tons and even a few at 35,000 tons may still be desirable for some special passenger line, but the very long ships of 1,000 ft. length and 35 ft. draught seem to be relegated to a future generation, say for the 30 years to come. We have therefore cargo boats of 8,000 to 10,000 tons, with a few up to 15,000 tons and passenger ships of 20,000 to 25,000 tons, with a maximum of 35,000 tons.

If shipowners and shipbuilders could come to an understanding, and agree that for about 30 years to come, they would build within the limits I have mentioned, it would be a very good thing for harbour engineers, because then we could easily improve those harbours that are not sufficiently commodious, without going to the enormous expense of providing for the very large ships, which in any case it is impossible to do at present, because the money necessary cannot be forthcoming.

On the other hand, to make a ship which will be economical both to build and to run, it seems that the depth usual in the past is not sufficient. Ship-builders think that they can make a cheaper ship which will be more economical to run if it has a slightly greater draught than has been customary hitherto, they mention that a draught of from 28 ft. to 30 ft. is desirable for the future generation of ships and 32 ft. should be quite the maximum limit. If this is so, and from the information I have been able to gather it seems to be the case, I think some conclusions may be drawn from that. The Panama Canal has a depth of 40 ft., and the Suez Canal has also the same depth. At present the depth of the Suez Canal is being increased, to 40 and then to 45 ft. : but this not so much in order to allow larger ships to pass through it,

but merely to allow ships to pass through the Canal more rapidly and without any danger or delay at the crossing places or « garages » as they are called. If we could agree on a depth of 32 feet as the maximum that should be required in the case of any harbour, we may come to the conclusion that a clearance of 3 ft. under the keel of ships using the harbour, making 35 ft. in all, would be quite sufficient for any first-class harbour, provided that the water is sufficiently calm. If there is some swell in the harbour the draught, of course, should be increased, to take into account the undulation of the waves which may occur. By limiting the depth of a harbour to 35 ft., with a maximum, say, of 40 ft., the sort of waste that was going on in harbour construction before the war will be eliminated.

We have in the Mediterranean, and I have seen in England, several quay-walls at least 40 ft. deep at low water. We are building two of these quay-walls in Italy, one nearly finished at Genoa and one not yet begun at present, at Trieste, the two most important commercial harbours in Italy; but I think this great depth is causing us an unnecessary expenditure. We are building these simply because there are a few harbours abroad frequented by the big « ocean greyhounds » which require this depth and so we must imitate these exceptional harbours. I think the « greyhounds » might be left out of account for a generation; and we should fix the limit of the depth of quay-walls to 33 ft. or 10 meters as being a most generous dimension, and dredge our harbours to the depth of 35 feet or 10,50 meters and always remembering that that depth is only applicable where the water is calm, and must be of minimum depth at low water.

With regard to the passage from one dock to another, if there are no locks, it is better to make this passage a little more commodious than that of old, and we consider that a width of about 165 ft. or 50 meters is quite ample and sufficient for any purpose. If there are locks or swing bridges across the passages the expenditure will become very great and then we should be a little more economical in our dimensions and be content with 120 ft. or 56 meters, which is a little more than the dimension adopted for the locks and swing bridges on the Panama Canal and answers very well there.

Dry-docks for the repair of ships must also be considered. Such docks are not numerous and they have to last for a very long time, so we might be a little generous in that regard and have a draught on the sill of at least 30 ft. or even 35 ft. We have dry-docks in Italy with a depth of 40 ft. and a width of entrance of 35 meters, or about 120 ft., and one with a width of 40 meters, or about 130 ft.

We have this exceedingly wide and deep dry-dock because built for special military purposes. A man-of-war come in, perhaps in a damaged condition, and she must always find 35 to 40 ft. of water on the sill in order to be able to get in safely. She may come in also in a very bad condition and have to be supported by floaters on both sides, and she must be able to get inside the dry-dock with the floaters attached.

For a commercial harbour we should be more economical and a depth of 10 meters or 33 ft. and a width of 36 meters or 120 ft. should be sufficient.

In conclusion, I think we must draw our horns in a little with regard to this question of the « dimensions of harbours », because otherwise we shall not be able to carry out new works for lack of money. As I said, the tendency nowadays is not to increase the size of ships but rather to go in for greater draught and perhaps greater speed, but within the limit of a maximum draught of ships of 9-9.50 meters or 30 to 32 ft., and a maximum depth of water at the quay-wall of 10 meters or 33 ft. at low water: and of 35 feet or about 10,50 m. in the dock in front of the quay or in passages between the docks and the outer harbour.

If we could all agree — ship-builders, shipowners and harbour engineers — on these dimensions, which are quite ample for practical purposes, and adopt them as the «*normal dimensions*» for all important commercial harbours, I believe, we would do a great service to shipping and harbour interests : that is provide ample facilities for large mercantile ships without any extravagance and within limits of reasonable expenditure.

The Chairman. — I think we might in the future confine our discussion to the commercial aspect of these questions. Prof Luiggi has given us some information about dry-dock facilities

in Italy which were brought into being in view of the possibility of men-of-war coming in damaged, but I think that it is not a question with which we are concerned. We have to deal with the matter, I think, from a purely commercial point of view, and should address ourselves solely to that, leaving out of consideration the military aspect of the matter, which our respective Governments must look after themselves.

Mr. Babin (in French). — M. Quellennec, Consulting Engineer of the Suez Canal Company, intended to speak on the first question, but he will only be able to come to-morrow morning and he begged me to ask you to be kind enough not to close the general discussion before hearing him. I should like to make a few remarks about the project of conclusions proposed by the Reporter General on the first question. In group B to the number 7, the Reporter General proposes the following conclusion :

« There is a consensus of opinion in favour of a width of 35 feet » from cope of the wharf-wall to the sheds, and perhaps 40 feet » in certain places. »

Besides, the Reporter General of the 2nd question, in paragraph nine of his conclusions, proposes to say :

« an ample width should be provided, that is 50 feet (16 m.) » between the facing of the quay, and the sheds or storehouses ».

The width to be reserved depends on the nature of the goods, on the way they are brought in and evacuated, on the number of railway tracks necessary, etc. If we wanted to take these different conditions into consideration, we could say :

« A width of 35 feet (10,67 m.) is often adopted between the » end of the quay or landing stage and the outer facing of the » sheds; this width is extended to 40 feet (12,19 m.) in certain » ports. These two widths also permit the laying down of rail- » way tracks.

» In several cases, it has been recognised useful to dispose 3 rail- » way tracks, alongside the quay, or of a larger place for landing » the cargo, before storing it in the sheds a width of 50 feet » (15,24 m.) is then preferred. »

I also draw the attention of the Congress to the observation of M. Clavel, Inspecteur General, in his report n° 31, concerning the

utility which the establishment of calling places for boats on the coast presents for inland ports far from the sea.

This observation should be inserted in our conclusions, for instance under the following form :

« It can be advantageous for an inland port far from the sea, » to create near the coast, a port of call for great liners, in order » to reduce the duration of the voyage, this port forming an outer » port depending on the principal port and placed under the same » control. »

Moreover, the general conclusion concerning the constitution of a permanent Committee with a view to conciliating the various interests present, to try to reduce the cost of the construction of ports, appears of a doubtful efficacity and it would be useful to revise it.

Finally, I think it would be a good thing, to constitute a sub-commission of a few members, which would be entrusted with the revision of the project of conclusions, and would try to simplify them by simply retaining the principles which will proceed from the general discussion.

The Chairman. — One of the suggestions which I think we could all at once readily agree with is that we should appoint a small committee for drafting a resolution upon which we can vote. In these two summaries of the reports by Mr. Savile and Mr. Wilson, we have a number of conclusions and suggestions given. I think it would probably be better, before attempting to draft any resolution on which this Congress might vote, to leave the general question, which has been put before you, open for discussion, and, after full discussion has taken place, and the general view of the Meeting is apparent, draft a resolution for general approval.

For instance, on this question of the width between the quay and the shed, you will find that Mr. Savile suggests 35 or possibly 40 feet, and Mr. Wilson a minimum of 50 feet. Mr. Babin, on the other hand, suggests a minimum of 30 feet. There is room for discussion there as to which is the better width. I think, therefore, that, by to-morrow, we should be able to draft a resolution which would embody these conclusions with any modifications which you may think desirable. The question had best be left

open for further discussion at present, but before this Meeting closes we might appoint a sub-committee as suggested by Mr. Babin.

Mr. Piau Ling. — Mr. Savile has just given you a brief outline of the Chinese report on the Wangpoo conservancy. So I will confine my speech to three of the reports which have arrived too late for publication. These reports deal on the improvement works respectively carried on in the Chefoo, Tientsin and Hulutoa harbours.

1. The Chefoo project embraces the closing of a large area of water (about 250 acres) by the construction of a breakwater and mole; that is to say, a) an eastern breakwater, 2,600 feet long, providing an entrance at either end, the northern entrance between the breakwater and the mole and one at the south-eastern corner between the breakwater en the « Tower Hill »; b) a western mole, 5873 feet long with a quay-wall 600 feet on the northern arm of it, and (c) dredging of a great part of the shelter formed by the breakwater and the mole to twenty feet below Chefoo zero, which means 22 feet at mean low water. An area of 900 feet by 450 feet near the breakwater is to be dredged to 25 feet below C. Z.

2. The improvement works, thus far carried out in Tientsin, consist principally of the closing of several lateral channels which tend to kill tidal action in the river, the cutting off of sharp bends; dredging and further some training and shore defence work.

3. The construction of the harbour of Hulutao is as follows : a) the dredging of the harbour to the depth of 8 meters for so far this is necessary and the dredging of a trench for the foundation of the breakwater: b) the construction of the breakwater, the construction of the quay wall and the construction of a so-called construction pier necessary during the carrying out of the works which afterwards will have to serve as part of a extra pier when extension is necessary; c) the removal of a small hill adjacent to the harbour basin to the west and the reclaiming of the land behind the first part of the breakwater besides the filling in of the breakwater proper.

The Chairman. — I will ask Mr. Saville to explain these diagrams which we have here.

Mr. Savile. — I only wish to call attention to the fact that these diagrams are enlargement of those which are incorporated in my paper. This diagram is the one which places on record the conclusions arrived at from estimates prepared that the cost of harbour and dock schemes would vary approximately as the cube of the depth. I think it rather implies what Prof. Luiggi pointed out : the enormous cost which is involved through these large and deep-draught ships. What I was trying/ to prove, or get agreement on was that, although it might be necessary to increase the size of ships, and might be commercially profitable to do so, if that size could be increased while at the same time the depth was limited, it would be of enormous advantage to all concerned, because, although the cost with regard to increasing draught, as I have tried to prove, goes up as the cube of the depth, the cost of increased length and beam only vary as the length and the beam. I think it would be very interesting if any gentleman present who has read this paper and been good enough to go through the estimates and figures on which these curves are based, would criticise them and, if possible, either prove the conclusions to be correct or refute them.

The other diagram is simply an illustration to get out a formula to connect the tonnage of ships with the draugth, and, although there is a large number of ships represented there, the line drawn would perhaps appear not to be an average line. That line is actually drawn by taking 30 ships of each draught and averaging that, and then drawing a line, and the actual ships were put on afterwards, so that although the line does not appear to give absolute average, I think it is very nearly correct.

The Chairman. — If it is your pleasure, I think we might appoint a Sub-Committee to consider the question of drafting a resolution to embody the suggestions which have been put forward, so far as it may be considered desirable and acceptable to do so. I would suggest that the Drafting Committee should not be too large, but I should like every country to be represented on it which wishes to be so represented.

The following Committee was appointed :

Belgium : M. D. Bouckaert.
France : M. C. Babin.
Great Britain : M. L. H. Savile, M. M. F. G. Wilson.
Italy : Prof. Luiggi.
Netherlands : M. H. S. de Roode.
Denmark : M. G. Lorenz.
Brazil : M. F. C. Burlamaqui.
Japan : M. K. Sugie.
United States America : Capt. F. T. Chambers.
China : M. Piau Ling.
Sweden : M. P. G. Hörnell.

The Meeting then adjourned until 10 a.m. the following day.

SECOND SECTION

(Ocean Navigation)

SECOND MEETING

Tuesday, July 3rd, 1923

Sir Maurice FITZMAURICE, C.M.G., F.R.S., in the chair.

The Meeting is called to order at 10 a. m.

The Chairman. — Sir Ernest Glover, the Chairman of this Section, is unable to be present, and has asked me to take his place.

Certain resolutions were sent to a Committee yesterday for drafting and that Committee is now dealing with some of them. In the meantime we had better, I think, continue the discussion on Questions 1 and 2, and I call on M. Quellennec, the Consulting Engineer of the Suez Canal, to open the discussion today.

M. Quellennec. — Mr. President, Gentlemen. I make my excuses for not having been present at yesterday's meeting. I was called away by other duties.

In many of the papers relating to the 1st Question, the present and future situation of the Suez Canal is mentioned from the standpoint of the depth of this navigable waterway, and the consequences thereby resulting for the fixation of the maximum draught of ships. The figures indicated by the Authors of these papers are often exact, but not always. The conclusions drawn from them are not always true : either it is then useful to give to the Second Section of the Congress precise information on this subject.

From the 1st of January 1922, ships were authorised to pass

through the Suez Canal with a maximum draught of 9m45 (31'). But since the year 1912 the Company has decided to carry out a programme of improvement works consisting of the deepening of the Suez Canal to 12 meters (39' 4") the object of which was to permit the passing of ships of a gross tonnage of 28,000 tons (220 m. in length, 28 m. in width and 10 m. (33') of draught). The execution of this programme was delayed by the war ; nevertheless it will be finished at the end of the next year.

Without waiting for the completion of the 1912 programme of works, the Suez Canal Company worked out in 1921 a new programme of improvements which was definitely approved in 1922 by the International Technical Consultative Commission to which each year the Company submit a report on the state of the canal and on the projects contemplated. This programme provides for the deepening of the canal to 13 meters (42' 8") and for the passage of ships of a gross tonnage of 45,000 tons (265 m. of length 29 m. of width, 10m67 (35') of draught.

It is to be noted that the depth of 13 meters (42'8") was considered excessive by certain members of the International Consultative Commission; finally, it was adopted on the formal request of the Suez Canal Company, who observed that it was advisable to provide a margin between the draught of ships of the greatest tonnage and the available depth of the canal, and to reckon on a sanding up of the bed that might attain a height of about one meter at certain times and places, since the periodical cleaning of the whole of the canal is distributed over a period of 5 to 6 years After these consideration it can be said that the depth of 13 m. (42' 8") is decomposed as follows :

Draught of ships	10m67	35'	Available depth :
Margin between draught and available depth of canal	1m33	4'5"	39'5"
Possible sanding up on the floor	1m00	3'3"	Total depth
	13m00	42'8"	42'8"

In reality, it is seldom that the sanding up of the bed reaches 1m. in height, and we can arrange that the sanding-up remains below this limit, by accelerating the dredging. Moreover a margin of 1 m. (3' 3") between the draught and the available depth is

strictly speaking, sufficient; we see then that the new programme of the Company will permit, when realized, to authorize draught to be extended if needs be to 36'.

These explanations show the differences there are between the useful depth of water, or mooring, of canals, basins and docks the initial depth of water of these same works at the time they are constructed, and the draught of the ships admitted to them. In ordinary language and often in official and technical documents these three points are confounded to the detriment of correctness and reality.

This observation is particularly important when it is a question of a maritime canal. Indeed, the ship taking up, if it is of great dimensions, a very important part of the canal, the displacement of water caused by its passage, makes strong currents, which would become far too violent, and would produce excessive damage to the bed and banks, if there was not under the keel sufficient space to allow the displaced water to flow away easily.

Moreover, very conclusive experiments, effected on the Suez Canal in 1905 and repeated in 1922, showed that the displacement of a ship in a section relatively narrow, causes a lowering of the water level and in consequence the drawing closer of the ship's keel to the bottom.

This sinking measures usually 0^m40 to 0^m50, for the normal speed of 10 km. the hour, it augments rapidly when the speed increases, attaining in certain cases 0^m93 for a speed of 15 km. ; therefore the necessity admitted by the Suez Canal Company to provide for a margin of at least one meter (3' 3") between the available depth of the canal and the authorised draught.

In the basins and docks on the contrary, where the water section is always very large in relation to the displacement of the boats, and where these only displace slowly, this phenomenon of sinking is not very great, and consequently a reduced margin may be readily admitted, 2' and even less, between the available depth of the basin and the draught of the ships.

Moreover, it should be noted that contrary to what is the custom for the ports, the Suez Canal Company does not indicate officially any depth, and simply declare the authorised draught.

Whilst the Captain of a ship is allowed, on his own responsibility, to judge whether or not he can enter a port, in the Suez

Canal on the contrary, it is the Company which assume this responsibility, provide the ship fulfils the conditions imposed. The Suez Canal Company is then bound to investigate with the greatest care the problem of the proper depth to be provided for the admittance without any risks to ships authorised to pass through the canal.

As already mentioned, the draught at present authorised is 9^m45 (31'). If we look back on the past, here is what the statistics of the Suez Canal relating to the question of draught teach us.

The canal was constructed and opened in 1869 to navigation with a depth of 8 m. ; the draught authorised was then fixed at 7^m50 (24' 7'') and it has remained such until 1890.

The 15th of April 1890, the ships drawing 7^m80 (25' 7'') were authorised to pass through the canal, and from the first year, 145 crossings of ships utilising this faculty, were registered.

The 1st. of January 1902, the passage of ships drawing 8 m. (26' 3'') of water was authorised and navigation from the first year, availed itself of this opportunity for 123 crossings.

The 1st. of January 1906, the passage of ships drawing 8^m23 (27') was authorised and navigation benefited from the first year by 135 crossings.

These figures show that up to this time, the increase of draught authorised for the Suez Canal was expected by the shipowners, since a great number of present ships were only waiting for the authorisation of the Canal Administration to go through the canal.

The situation began to change in 1908, which saw the authorised draught increased from 8^m23 (27') to 8^m53 (28') ; the first year, it was found that 63 ships made use of this faculty.

In 1914, a new increase of draught passing from 8^m53 to 8^m84 (28' to 29') was only utilized for 49 crossings.

The two last increases. that of 8^m84 to 9^m14 (29' to 30') authorised 1st of January 1915, and that of 9^m14 to 9^m45 (30' to 31') authorised 1st January 1922, were only utilized the first year for 6 crossings, and the second for 5 crossings, that is about 1 % of the total number of crossings.

The statistics then clearly demonstrate that if the improvements made to the canal were up to 1906 expected by navigation, it has not been the same since then, and that henceforth, there exists

only a very small number of ships ready to utilize the facilities offered. Of the 5 ships taking advantage of the increase granted the 1st of January 1922, not one reached the authorized maximum of 31'.

In a general manner, the ships with a large draught are very few, thus in 1922 it was found that there were only 113 crossings of ships drawing 28' to 31' of water, *that is 2,6* % only of the total crossings.

The Suez Canal Company did not continue any the less to improve the navigable waterway of which it is in charge, a new increase of one foot in the authorised draught from 31' to 32' is reckoned on for the beginning of next year, and after the completion of the 1912 programme of works, that is to say in 1925, the passage of boats drawing 33' of water will be able to be authorised.

So much for the near future ; now for a more distant future the Suez Canal Company has already begun the 1922 programme of which the execution will permit, as previously stated, the authorised draught to be increased to 35' and if necessary to 36'.

If we pass from the consideration of the draught to that of tonnage, here is what the statistics of the Suez Canal teach us.

During the last twenty years, the average gross tonnage increased on one average 114 tons per year, passing from 4,418 tons in 1903 to 6,585 tons in 1922.

From 1903 to 1914, the increase was 107 tons, thus remaining very near the general average.

During the war, from 1914 to 1919, the average gross tonnage remained nearly stationary, only varying from 5,595 to 5,500 tons.

On the other hand, since 1920, the increase was exceptionally rapid, reaching 360 tons per year. This great increase is purely due to the impetus given to naval construction after the war, partly also to the fact that the years 1914-1919 were years of commercial depression.

The observation indeed shows that the increase of the average capacity of ships which pass through the Suez Canal is not produced regularly, and it is much less in periods of prosperity than in periods of commercial depression. This is explained by the fact that in periods of great activity, the increase in freight rates render the employment of old ships of small dimensions more pro-

fitable; the needs of commerce thus bring about the employment of ships of small tonnage, which has the effect of partly concealing the increase due to new units.

On the contrary, in periods of commercial depression all the old ships remain in the ports, and the only ships which pass are those whose working is economical, that is to say, modern ships larger and better equipped. It is this which happens in the period we are now passing through, a period of commercial depression acknowledged by the statistics of the Suez Canal ; for if these statistics show in 1922, a total tonnage of a draught little more than that of 1913, they only register a goods tonnage of 21,360,000 tons (8,192,000 tons North-South, and 13,168,000 tons South-North) instead of 25,776,000 tons in 1913, (11,320,000 tons North-South, and 14,456,000 tons South-North).

The detailed statistics throw into relief that altogether the ships of a tonnage less than 6,000 tons gross become less and less numerous, while those of a tonnage greater than 6,000 tons are becoming more numerous; however, there is practically no increase for ships of a burthen greater than 12,000 tons.

The number of very large ships is still very limited ; in 1922, only 5 ships of over 16,000 tons, including an English battle ship, the « Renown » went through the canal.

The largest ship having passed through the Suez Canal is the « America » of a gross tonnage (Lloyd Register) of 22,622 tons ; this ship crossed in 1920 with a 30' draught. The Lists of Lloyd and Veritas in 1923, only mention 16 ships of a tonnage greater than the « America ». Of these 16 ships 8 of a tonnage slightly greater than that of the « America » could make the crossing from now on, by the Suez Canal ; then there only remains 8 ships which could not be admitted at present. What are these ships. They are exclusively rapid passenger boats, connecting up Europe and North America, and there are but few ports where they can call, and these are specially equipped to receive them.

Will such ships become more numerous in the future ? It is at least doubtful for the reason given in detail in several of the interesting papers submitted at the 2nd Section of the Congress. Moreover these ships which are only suitable for a special traffic, and a fixed clientele, and which can only be accommodated in

special ports, would not find employment on the lines which pass by the Suez Canal.

We have a right to say that the Suez Canal, which may see again all the ships existing in the world, except the 8 just mentioned, accepting from now on the ships of a 31' draught, and which in 1922 saw no ship take advantage of this faculty, which in the same year 1922 only registered 29 crossings of ships drawing more than 29' and 113 crossings of ships drawing more than 28', does not limit in the slightest, at present, the extension of naval construction. We can even say that with improvements now under way, which will soon permit the authorised draught to be brought to 33', and with its programme of future improvements which contemplates a 35' draught and even 36' the Suez Canal is ahead of naval construction, at least as far as concerns navigation meant for purposes of trade.

The question of the situation of the ports in relation to large ships is not the same as that which concerns all the ports.

Thus as most of the authors of papers presented to the 2nd Section of Congress explained, it does not appear reasonable to undertake in the ports, in order to receive the superliners, extremely expensive works which would only be of use to a very small number of ships.

So much the more, if we draw a parallel between, on one hand, the advantages that navigation gets from the use of these few ships, and, on the other, the expense that the necessary works would entail for the admission of these boats into the ports, thus such as handling of goods, storage, and the clearance of their enormous cargoes, we begin to doubt whether the community at large will get a real profit from the employment of such ships.

The Suez Canal Company noted with interest the suggestion developped by Mr. Savile, in his General Report on the First Question, to establish, with a view to coming to a solution giving reasonable satisfaction to the various interest at stake, an organisation which would bring about a direct and consistent connection between Port Administrations, the Shipowners and Shipbuilders and Railway Companies, so as to centralize and examine in any discussions where those interested would be represented, the questions relating to the construction and use of superships.

Such an organisation would be able to supply for all these ques-

tions, precise data and the general views which are now lacking, and of which the Suez Canal Company would be glad to avail itself, when the opportunity occurs.

Mr. A. H. Roberts. — I should like to make one or two remarks on the papers, but I will be very brief.

M. Boomsma, of Rotterdam, suggests different depths for different docks. Mr. Boomsma is in the happy position of being able to carry out that suggestion without much difficulty in his particular port, but in most of the ports that are already established it would be difficult to do so. To some extent, probably the suggestion is already met, because docks have gradually developed and the older docks are smaller. Each new dock that is built is made larger that the earlier ones, but, at the same time, the older docks are usually more restricted both in size and quay space, and also in shed space and in room for cranes and appliances. It is difficult for an engineer in this country to see how the proposal in question could be adopted, although I think it is an excellent one for Rotterdam considering the special circumstances of that port.

With regard to conclusion n° 2; in Mr Savile's summary, under group B., the difficulty of finding full cargoes seems to be a matter of considerable interest to all except that the very largest ports, such as London and Liverpool, taking this country as an example. The large ports have to meet their special conditions, but the lesser ports are also of great importance to the country, and their requirements have to be born in mind.

In conclusion 4 of Group B. Mr. Savile points out that the equipment of a port with all labour-saving devices and with adequate railway connections for the economical collection and delivery of cargo as well as for the rapid and cheap loading and unloading of vessels, is of no less importance than berthing accomodation for ships. I would like to confirm and emphasize the importance of that conclusion, which is one that should not be lost sight of.

With regard to the question of quay widths, I am particularly anxious to say a word or two on that. Several speakers yesterday, and several of the papers, advocated various widths of quay. 30 ft., 35 ft., 40 ft. and 50 ft. were spoken of. It seems to me

that these considerations are too theoretical. The width, to my mind, must be dependent on the character of the traffic to be handled. That may differ in British ports, European ports, Eastern ports and so on. The requirements are so different, both as regards import and export. In some ports the goods are immediately despached by rail, loaded up and sent away at once. In some ports a very large proportion of the goods has to be taken away by road; in some, one of which I know very well, about one half is handled by rail and the other half by road, and motor-lorries have to be provided for everywhere, just the same as railway trucks. The question of whether a cargo has to be carried straight to a shed for storage affects the width of the quay. If there is a special case where cargoes have all to be taken into sheds by hand, I would say that a very narrow quay is desirable, though personally I can hardly conceive such a state of affairs existing, though of course it may. If, however, a lot of goods must be taken away promptly by rail, a certain number of rail tracks are required and the width of the quay must depend on the number of rail tracks. Some people are satisfied with two lines; some, I think rightly require three, and the number of tracks required and the gauge of the rails seem to me to be a controlling factor in the determining the width of the quay. In the case of the latest shed we have erected, we have three tracks in front, then a good broad shed, and two tracks at the back of that, which we take to be the minimum for that class of work at the particular quay. There are some ports where the authorities are hampered by having no rail accommodation provided on the quay in the past, and they have recently, and at considerable expense, been remedying that situation. They are up against great physical difficulties as regards the position of the shed, and also human difficulties with regard to customs and habits and vested interests. One quay at our port is to be re-equipped shortly because it has only two lines of rail, and the outer line is occupied by rather old fashioned cranes of solid pattern. It is necessary to put down a third line of rails and there is no room for two crane legs. It is intended therefore to put the back crane-legs on the shed, so as to give three full lines of rail. The track nearest the ship is used to discharge directly from the ship; the track

nearest the shed for taking goods in and out of the shed, while the central line is kept clear for shunting purposes and capstan work. It seems to me, therefore, the width of the quay is not so much a theoretical matter, but depends rather on local requirements—the number of tracks, the gauge and the clearances necessary on the quay and at the shed and the amount of room required for cranelegs. Add those together and you will find the width necessary for the quay. The governing consideration in the whole matter is the rate of intensity of discharge of the ships.

As regards the third suggestion in Group C. of Mr. Savile's summary, proposing heavier dues for large vessels, this is rather a delicate subject. When that suggestion is made, as it sometimes has been, it is immediately countered by the fact that ships of greater depth have such a difference of tonnage to carry that they pay quite enough extra money in heavy dues for their size. Two years ago, at an Engineering Conference held here, my late chief, Mr. Meik, expressed the view which I think is a very sound one, that if huge vessels, such as were referred to yesterday as greyhounds, are to be encouraged, it is not economically sound, from the national point of view, for every port, or a large number of ports, to spend huge sums to entertain one or two of such vessels. He suggested that if these large ships were absolutely necessary, a port should be selected by common consent preferably on the west coast of Britain, and all the greyhounds should be berthed there. That is an ideal suggestion which, from my knowledge of human nature, and the competitive principles at operating ports, I do not think it is likely to be adopted; but I should like to say that Mr. Savile's closing suggestion that there should be some co-ordination between ship-builders, shipowners and dock authorities might possibly meet that point. If it is sound economy in war time to look at matters from the point of view of wasteful expenditure nationally, it surely must be sound economically to do the same in peace time. It is a question whether that view, or the desire to have keen competition everywhere, should prevail.

I should like to add to Mr. Savile's list of those who should take common action with a view to co-ordination stevedores and Railway Companies. Railway Companies have their own diffi-

culties to face, and are facing them all the time, but at the ports it does seem to me that there should be co-ordination between all those whose interests are involved in order that the whole transaction of transportation may be put on the most economical basis.

Prof. L. Luiggi. — The Drafting Committee has already finish with the Second Question, and I think Mr. Wilson is ready to read the conclusions we came to. Mr. Savile will also be ready soon to read the conclusions reached on the First Question. As the two are independent, I think we might begin with the second.

The Chairman. — I will ask Mr. Wilson to read the resolution on the Second Question submitted by the Drafting Committee.

Mr. M. F. C. Wilson. — The following resolutions have been agreed to by the Committee appointed to draw them up.

1. *When planning new docks, it is desirable that at least three feet of water should be allowed under the bottom of the vessels.*

2. *It is desirable that defences (that is, fendering), either fixed or movable, should be provided between the vessel and the quay.*

3. *The quays should be furnished with mooring bollards, rings, boat steps, ladders and conduits to carry electric cables, water mains, etc.*

4. *At present, continuous quays constitute, in general, the best solution, wathever may be the nature of the traffic. In certain circumstances, detached wharves, connected with the shore by gangways, may be desirable.*

5. *In considering the design of new works, or remodelling old works, care should be taken to provide easy connection with the main railway system.*

6. *Satisfactory means should be provided for the rapid handling of passengers, luggage and cargo.*

7. *The quay surface should be hard and smooth, suitable for wheeled traffic.*

Mr. L. Luiggi. — These resolutions were agreed to by the Committee unanimously.

Sir Westcott Abell. — I do not know that I am competent to say much from the general engineering point of view. In regard to the probable growth in size of ships during the next few years, I think the main point to which attention should be given is the very fascinating, though not very satisfying one of economic tendency. As a matter of fact, shipping is going through a very strenuous time at present, and is likely to have a strenuous time for some time to come, and therefore I think it is the economic operation of shipping which determines the size. Speaking for myself, I think the tendency for the next four or five years will be to keep down the length of ships, and of course we shall have, during that period, to restrict the draught in accordance with the ports.

I should like, however, to draw attention to the last conclusion of Mr. Savile's report. I do think it is a very necessary thing, particularly in regard to the largest vessels, to pool all the resources of the country. Large vessels are only demanded where the passenger traffic is heaviest, and therefore, in the consideration of the very large vessel, it is the needs of the whole country rather than the needs of the locality which have got to be considered. I do hope, therefore, that something will come of this suggestion to appoint a sort of Sub-Committee which will study the matter more particularly from the national point of view.

With regard to the Suez Canal problem, I think the tendency is for passenger traffic to increase, and, therefore, for the size of ships to go up ; but, on the other hand, the economic conditions of the Eastern Routes are not nearly as favourable as on the North Atlantic, and I should judge, from what the Chief Engineer of the Canal said just now, that canal development will proceed equally as rapidly as development in the size of ships.

There is one other point which should be realized in dealing with the general question, namely the large growth in what I might call the cargo-liner type of vessel. One of the results of the war seems to have been a transfer of tonnage from the cargo ship group, the ordinary « tramp » steamer, as we quite wrongly call it, to the liner group, which mean that you have to provide for larger ships for the same quantity of cargo transported. That is rather an important factor, but I am not sure it is a perman-

ent one. I rather fancy that the tonnage of this country which is allocated to general cargo ships, apart from operation on fixed lines, is below the natural demand, and I should expect to see some increase towards the pre-war proportion, but not back to it, because there must be a certain amount of tonnage free for general operation as distinct from operation on fixed lines.

Then, of course, there is another phase of the problem, which have to be studied in every country, and particularly in this country, although we do not make nearly so great a use of it as we might do, namely the local distribution of goods by sea, firstly for the feeding and supplying of local communities, and secondly to act as feeders to the big ships proper. I rather fancy that, owing to certain circumstances outside the scope of this discussion, our coastal services have been cramped and hampered in a way which is prejudicial to the best interests of the country.

Mr. T. S. Gilbert. — I would like to mention one point with regard to the question alluded to earlier this morning, namely, the necessity of having three feet clearance underneath the bottom of a ship. I take it that this refers to three feet underneath the bottom of the deepest ship for which the dock is designed. Assuming that the figures regarding the costs of construction varying as the cube of the depth, are correct, one or two feet more depth than is absolutely necessary would be exceedingly expensive. Not only so, but the bottom parts of a dock wall, or dock, are the most expensive; and I would suggest that where there is a soft bottom, to have three, or even two, feet more than is required by the maximum ship would be too expensive. I may say that at Belfast very large ships have been taken in and out of the channel, and so far as I can remember none of these ships ever had three feet clear underneath the bottom; some of them have gone in and out with as little as one foot. Now if such ships can be moved up a channel about four miles long safely, with less than three feet under the bottom, say two feet, or eighteen inches— I suggest that a minimum of three feet in a dock where is not much moving about is excessive. Our channel bottom is quite soft, and the large ships had tugs.

There is another matter I should like to mention that is with

regard to the width of quays; thirty feet, and up to fifty feet was mentioned. I would suggest that while that is quite applicable and may be quite right in the case of docks and quays where the bulk of the goods is immediately placed in railway wagons, there are other docks to which it would not be applicable. At Belfast Harbour, with which I am connected, the bulk of the goods is either carried immediately into the sheds and partially stored, or put into motor lorries and carts, or over the side into smaller ships. Our dock labourers have very strong opinions as to exactly how much work they will do for a day's pay, and I have no doubt the same is the case everywhere. At present the majority of our foreign docks have no rails between the coping of the quay and the sheds, and if we were to set these sheds back from 30 to 50 feet, there is not the least doubt that it would mean a very considerable increase in the cost of handling; our dockers would not do it at present prices, and the quays would immediately go out of favour, as the ship-owners would not use them if they could possibly get others. I would suggest that an exception be made in the resolution for quays or docks where the bulk of the goods is not to be put on the rail, but on motors or stored in the sheds.

M. Quellennec (in French). — I think an extension of three feet to the quays is a great deal for most of them. I am of opinion that ships can be manœuvred in a smaller space. It is important to take notice of the docks where a filling in of mud may occur. It is also important to have rapid manœuvring. But in the ordinary docks where filling up of mud is not considerable I think that a foot and a half is more than sufficient.

As it is certain that the increase of 3 feet in the height of the quays will entail great expense, we should be quite right in maintaining the depth from a foot and a half to two feet in ordinary cases.

Captain F. T. Chambers. — I was on the Drafting Committee, and I agree with its findings. I was inclined to consider three feet rather large, but, inasmuch as it was stated « It is *desirable* to have three feet under the bottom of the ship », I thought it did

not make a great deal of difference, because it is *desirable* to have three feet. I think, where you have a muddy bottom, 1 1/2 feet is enough. I advocate the adoption of the conclusion put forward by the Drafting Committee with the possible exception of yielding to the wishes to those gentlemen who have spoken on the matter, and reducing the 3 feet to 2 or 1 1/2 feet.

Mr. Victor Prigg. — Referring to the question of tidal harbours, very often at Plymouth we have a tide that is below the datum of ordinary tides by as much as 2 feet, and even 2 feet 6 inches. That seems to be relevant to the question of the depth of water below the bottom of the ships passing in and out, because, in the harbour I mention, it is very often necessary to move these ships at low water, and the fact of having to deal with large vessels at low water must be considered. This limits the expenditure in procuring the depth of water in tidal harbours, rather than docks. It might be possible that 2 feet would be found to be satisfactory in many harbours

Captain W. F. Purdy. — Does this resolution apply only to docks using gates such as Liverpool, or to docks with open gates such as Glasgow. I think a distinction should be made, because, where you have a closed dock with no flow of water, the depth is sufficient if you have 1 foot going over the sill. After you are inside the dock, 2 feet is ample, if you have a soft bottom. I speak as an American familiar with British ports.

Mr. M. J. Watkins. — May I ask if these conclusions are now before us in the form of a resolution for our adoption ?

The Chairman. — They are before you in the form of a resolution for your adoption, and anyone can move any amendment they wish to them.

Mr. M. J. Watkins. — I should like to move an amendment with a view to throwing the matter into a somewhat different channel. It seems to me that, after all, the commercial question governs all these matters. (I am speaking now as General Manager to

the Belfast Harbour Commissioners). Commercial considerations govern the whole question. The Engineer naturally comes in with his help to enable us to solve physical difficulties, but ultimately the question has to be decided from a commercial point of view. Again, it does seem to me that it would be inadvisable to tie a Congress such as this to the expression, in a cristallised form, of some of the points contained in the resolution, as though they were matters of general principles, because, after all, they all resolve themselves into very local questions.

With regard to the first point,—that there should be 3 ft. at least under the keel of a vessel in a dock,—it seems to me, as Mr. Gilbert has pointed out, that there is a highly disproportionate expenditure involved there for an advantage which to me, at any rate, is not at all obvious. When a dock authority has to consider the provision of a dock, it is bound by considerations of economy, and it will want to know very definitely why it is called on to spend this disproportionate sum for an advantage which, as I say, is not at all apparent. We should oppose any such resolution being adopted.

With regard to the second point,—that it is desirable that fenders should be provided,—I think that is so self evident that it would seem almost childish for a conclave of all nationalities such as this to record it in the form of a resolution.

The same remark applies to the next point; these things are perfectly obvious; no-one would think of constructing a quay without them.

With regard to the point,—that care should be taken to provide easy connection with the main railway system,—that is surely a very elementary principle, and we have not come from all parts of the world to express it in the form of a solemn resolution.

As for the sixth point,—that satisfactory means should be provided for the rapid handling of passengers, luggage and cargo — that is an entirely local question. Some ports do not lay themselves out for passenger traffic at all, and it is a question with which they are not concerned. Others are in violent competition for the passenger traffic and it would be of little use suggesting to Southampton and Liverpool that they should enter into an agreement as to which should have that traffic. These questions

are for them to decide locally and in accordance with their particular capabilities and desires.

As for the last point of all,—that quay surfaces should be hard and smooth, suitable for wheeled traffic,—I think that is so obvious that again it would not do to put it into the form of a resolution. If the whole thing were to start of by saying : « In the construction of docks works it is desirable that the following point should be born in mind », that might make the proposals more acceptable, but I should not care to vote yes or no for them in the form in which they stand at present.

I am not casting any reflection on the conclusions which have been come to by the Committee.

The Chairman. — I think we all understand that.

Mr. Watkins. — But as a matter of policy, I think it would be unwise to express them in their present form. Any resolution adopted ought to record only broad principles of general applicability.

M. Coen Cagli (in French). — I quite agree with what the Reporter General has just said. All the conclusions concerning these questions are entirely evident. There is certainly a point on which nobody has spoken and which could adapt itself to conclusions of a more general character. It is the point n° 3 of the conclusions presented by the General Reporter.

When the range of the tide exceeds 15 feet, it is preferable to provide basins with entrance locks. It is a question of fixing the limit of the tide above which it is not suitable to have open basins. It seems to me that in a Congress of Engineers of whom several belong to ports giving access to seas with a great range of tide, the subject merits discussion.

From the point of view of a tide of great range, it should be ascertained whether the limit being reached, it is better to go up or go down in order to enter the closed-in basins.

Mr. J. Mallagh. — With reference to the provision of 3 feet of water under the bottom of the vessel, there are two points to

which I should like to draw attention. The first is in regard to cost. If it is correct that the cost increases as the third power of the depth, taking an average draught of 32 feet, the provision of an extra 3 feet on that, making it 35 feet, would entail an extra cost amounting to almost 50 per cent. of the whole cost I think, in view of the financial position in which most ports find themselves at the present time, and the general tightness of money, that is a very serious matter.

If we name a definite figure like three feet, in the event of an accident happening in a port where there is one foot or two feet, it would be a very serious matter for the Port Authority. I think that is a most important point.

Passing from the Drafting Committee's Recommendation to the general questions before the Congress, it is the opinion of the Shipping community and Port Engineers that the North Atlantic trade will continue to be of the character known as « Parcels Traffic », that is ships of ten to fifteen thousand tons register, will have their cargoes made up of parcels of grain or other goods, some of which may be as small as 200 to 300 tons, and these parcels will be consigned to and be discharged at various ports.

Assuming that the largest parcels are in the lower holds, it follows that the ship on arrival off the British Isles, may proceed to one of the smaller ports, at maximum draft. This is the more probable, in that, the loading of the cargo will have been arranged so that the ship will discharge the final parcel of cargo at a port where she is likely to obtain a return cargo. The result is that the smaller harbours are being called upon to provide accommodation for large ships, although the quantity of goods discharged at each port of call is relatively small, compared with the total cargo of the vessel. The expenditure so incured may be uneconomic although unavoidable.

The proposal to form National Committees on which Naval Architects would be represented, to explore the possibilities of Agreement amongst the various interests concerned, with regard to the maximum draft of projected ships, is one deserving of consideration and support by this Congress.

Mr. Patrick J. Munden. — I presume that these resolutions are

only laid down as broad principles to be followed, and that they do not bind any Port Authority or harbour Engineer to follow them implicitly.

The Chairman. — Certainly not.

Mr. Patrick J. Munden. — We ought to know that when we come to vote for these resolutions, because I would certainly like to agree with my friend from Belfast that we should not be asked to vote for a minimum of three feet below the bottom of the vessel.

Mr. V. E. Laknisky. — With regard to the second recommendation, on the Murman Coast, where we have to deal with ice, I think this would be a poor solution of the problem. I do not think those fenders can be preferable under all conditions. In the northern seas, where ice is encountered, it is better not to have loose fenders, but something stronger.

Mr. F. E. Wenthworth-Sheilds. — I think it is a great thing to get a Congress such as this, with representatives from all ports of the world, to exchange views, because there are certain questions as to dock accommodation on which we have been trying to get agreement for many years past, and so far have lamentably failed.

I refer particularly to the question of limiting the size of ships. Those of us who, like myself, have to do with ports where the very largest type of ship is accommodated are, of course, most anxious to know how much further the shipowner and the naval architect are going in their anxiety to outvie everything that has been done already. We have already got the 50,000 ton ship. Are we to expect a 60,000, a 70,000 and a 80,000 ton ship, and will it stop there ? That is the question we are all asking ourselves, and we are all saying. « Cannot we get together and decide what is to be the limiting size of the vessel of the future ? » Well, I do not know whether we can do that. I am very doubtful whether it will be done this year at this Congress, but I think Mr. Savile has very properly pointed out that the question is likely to be decided, not by the naval architect, who will build a ship as large as you wish, not by the shipowner, because he has found, so far, that the larger

he makes his ship the cheaper he is able to carry his cargo and his passengers per ton or per head, as the case may be, but by the dock owner, who will at last say to the shipowner: « I cannot take a larger ship than you are now sending me unless you pay increased dues per ton for the accommodation of that vessel. » Mr. Savile has pointed out, after looking into the matter very carefully, that to accommodate a boat drawing 40 feet of water means a cost of something like £ 200,000 per berth, and that if you wish to accommodate a ship drawing 50 feet of water, it is going to cost something like double that amount about £ 400,000 per berth, even at pre-war rates. From our experience at Southampton, I should say his figures are not far wrong.

Just before the war we constructed a large dock for the accommodation of the largest liners afloat, with some outside berths — 7 in all — and allowing for the different circumstances the cost of this works confirms Mr. Savile's figures. Today, of course, those figures would be very much greater. I think too that Mr. Savile is right in saying that the cost per berth will increase as the cube of the draught of the vessel to be accommodated; that is, unless we engineers can devise some means of cheapening the cost of construction.

Now, although this block of papers contains some very interesting matter on the subject of the construction of quay walls for large ships—and, after all, the quay wall is, one might say, the expensive matter in accommodating such ships—there is not very much hope to be gleaned from them that we are going to cheapen the cost of construction. One of the most suggestive papers in this respect is by our Irish friend, Mr. Gilbert, who has just spoken. He, perhaps, would say that he has not much money to spend, and therefore he has thought three times where most of us would only think twice as to how he can save in construction, and he has gone back to what we regard as the somewhat primitive method of constructing his quays with timber. The result is that he has got some very cheap quays. I suppose that most of us who are dock engineers will say, « That is all very well, but how long is your timber quay going to last ? » After all, it is no good building a cheap quay if in 15 or 20 years that quay has to be replaced by a new one. That is a problem which each port will have to solve

for itself. Mr. Gilbert, I believe, is fortunate in that he is able to use timber in such a way that it lasts for many years. Most of us, who have to build in sea water, know that timber lasts but a very short time. But I do think that if the engineers in this Congress could get together they might perhaps, with some thought, devise a means of constructing walls more cheaply than they have done hitherto. If we succeeded, we should give another ray of hope to the naval architect and to the shipowner, that they might send us a monster a little bigger than the last one.

Then, of course, there is the question of taking cargo out of big ships. Unfortunately, although it is quite possible to build quay walls and berths to accommodate them, we have found it difficult to take the cargo out of them any more rapidly than can be done in the case of smaller ships. Sir John Biles, in his paper, suggests that one can onload a small ship as quickly as a large one, because he points out that, although there may be more hatches in the larger ship, the cargo has to be lifted up a greater height in order to clear the ship. At all events, I think we may safely say that in the case of a large ship the amount of cargo handled per foot run of quay per annum is no greater than in the case of a small ship, and that is one of the reasons why, although the shipowner may increase his earnings by using a large ship, the dock owner is no better off.

I would just like to say a word about the width of quays, which seems to have given rise to a fair amount of discussion at this Congress. Eighty years ago the first dock at Southampton was opened. At that time, there was no thought of berthing 50,000 ton ships, but the railways were just coming into existence, and the engineer of that dock, Mr. Alfred Giles, who is famous as a Past President of the Institution of Civil Engineers, realised that the rate of unloading of ships was going to be very much faster in future than it had been in the past, and he therefore laid out his quays in such a way that there was a space of 30 feet between the coping and the shed. The shed itself he made 80 feet wide. He placed two lines of rails on the quay, and a line of rails inside the back of the shed. That was thought, at the time, to be a very extraordinary procedure, and I remember, as a youth, that the famous engineer Mr. George Lyster, of Liverpool, came down and

saw this arrangement and criticised it very adversely. To-day, Liverpool has adopted that arrangement and London has adopted that arrangement, and it is almost, one might say, standard British practice and standard practice in many other countries. I think it is of interest to mention this fact, and I am quite sure that, in the case of a dock that is going to be served by railways — and, after all, what modern dock is not served by railways ? — it is the right thing to make a good width between the coping and the face of the shed, and to equip that space with railway lines.

The Chairman. — If it is your pleasure, gentlemen, we will adopt the following procedure. Mr. Savile's resolutions on N° 1 Question are not quite ready, and I feel, myself, a certain amount of sympathy with the suggestions which have been made for some alteration in the resolutions which have been put forward on N° 2 Question. That being the case, I propose, with your consent, to ask the Committee to reconsider these resolutions in view of the discussion which has taken place here this morning and then we will take Mr. Savile's resolutions on N° I Question, and, if the Congress like to alter those also, we can deal with them in the afternoon, so as to give the Committee time to consider the matter.

The Meeting then adjourned untill 2,30 p. m. the same day.

SECOND SECTION

(Ocean Navigation)

THIRD MEETING

Tuesday, July 3rd. 1923 (afternoon)

Sir Ernest GLOVER, Bart., in the Chair.

The Meeting is called to order at 2.30 p.m.

The Chairman. — I should like to express my regret that I was not here this morning to take part in the discussion. I hear from Sir Maurice Fitzmaurice the steps which were taken this morning, and understand that you agreed to refer the whole question back again to the Sub-Committee which was appointed yesterday afternoon to redraft the resolution to be submitted to this Meeting. I propose firstly to read this redraft which I have before me. I am sorry there are no copies in existence to hand round. After I have read it I will ask Mr. Wilson to say a few words upon it. Mr. Savile reminds me that this is not exactly a redraft, but a draft embodying the questions Nos. 1 and 2; instead of having separate resolutions on the two questions it is proposed to make this one resolution covering both. I will ask Mr. Bonnet to read the French translation of this proposal and then I will ask Mr. Savile to speak to it, and perhaps as we have not copies to circulate he may think it desirable to read it again so that you may get clearly what is put down here. Then before asking you to vote on this resolution there will be a further opportunity for discussion on any points, if you think the resolution as drafted does not sufficiently clearly express the conclusions you arrived at this morning. I will now read the proposed resolution :

« *The XIIIth International Navigation Congress having read*

and discussed the 18 reports dealing with the first and second questions of the Second Section, namely, the accommodation to be provided for ships in connection with construction of new works at ports in order to satisfy the future dimensions of ships, adopted the following conclusions :

» 1. *That with regard to the probable future dimensions of ships there is a tendency, for economical reasons connected only with the cost of running, to a general increase in the draught, but although the percentage of ships drawing 30 ft. and over likely to be greater, this increase will be limited by the facilities offered by the main canal routes and principal harbours of the world, which should tend to check this increase in draught.*

» 2. *That there will be an increase in the average tonnage, more especially in ships of from 5.000 to 8.000 tons, but not in the tonnage of the largest pre-war ships in the very near future.*

» 3. *That the accommodation to be provided for ships should be guided by the consideration of true economy, and that, against any anticipated saving in the cost of running a ship due to increase in draught, the additional expenditure entailed at all ports at which such vessels will trade, entailing the necessary deepening of approach channels, berths, docks and wharf walls, locks, dry-docks etc., must be taken into account, it having been shown that the cost of the provision of these facilities due to increased draught varies as the cube of the depth.*

» 4° *That the provision of the facilities for the rapid and economical discharge of goods on arrival at a port is as important as the provision of deep water quays, as the cost of handling goods in the large sheds and wide quays necessary to fill the larger deep draught ships to ensure quick despatch is an important item in the cost.*

5° *It may be useful in connection with and inland port situated at a great distance from the sea to construct a port of call for ocean liners near the coast, under the same administration as the inland port.*

6° *That with regard to new and recently constructed work it is noticed that, in certain instances, 40-ft. of water has been provide for Atlantic liners, the depths provided for cargo vessels generally have been much more modest. And it is considered that as the*

trade of a port is, and will continue to be, largely dealt with in ships of moderate draught, the deep draught ship should pay proportionately greater harbour dues.

7° *That except for the Atlantic passenger service, it is considered that, when everything is taken into account, it will be difficult to justify the necessity for a depth of water at the quay side of more than 35 ft. at low water ordinary spring tides for many years to come, while a port providing 30-ft. of water at low water ordinary spring tides should be considered a first class port.*

General Conclusion.

8° *The Congress proposes that these question Nos 1 and 2 be referred to the next Congress, and that in the meantime each nation should make an exhaustive study of this subject by the representatives of the various interests concerned, namely, shipbuilders, shipowners, Dock authorities and Dock engineers, as the want of this co-ordination in the past seems to have been a serious defect in port development.* »

Mr. Goossens, technical secretary, translated then the resolution into French.

Mr. M. F. C. Wilson. — It as always appeared to me that this particular question as to the type of quays was not one on which you could lay down definite rules and definite resolutions and I stated in the General Report that such questions did not appear to me suitable as a basis upon which to form general conclusions. I had been informed that certain conclusions had to be put forward for the sake of discussion and those that were put forward were of a very general nature. I quite agree with what was said this morning, that they are very general and mostly obvious conclusions which come from the various Reports which have been presented. I think it was an exceedingly good idea to combine the two questions and accept these general resolutions which cover the whole of the two questions. Personally I entirely agree with what has been done in the matter.

The Chairman. — Perhaps Mr. Savile will speak on the subject.

Mr. Savile. — I am afraid when I gave the Chairman the draft copy of these resolutions I forgot to alter the number of Reports in the first sentence to cover the second as well, so that 17 in the second line should be altered to 24.

Also the preamble of the second question ought to have been inserted after the preamble of the first question, namely, « Types of Works for berthing ships of great draught in Tidal Seas » These general conclusions, apart from the general question of referring the whole matter back to the next Congress, were arrived at by the Committee after a very long and careful discussion and were drawn up after going through the conclusions which were laid down in my Report, which were laid down intentionaly rather in an extensive manner in order that they could be more easily discussed. Several of the particular items were omitted and others were combined and the redrafting of those resolutions is intended to take the form of giving the general sense of the conclusions that were in the General Report that remained over after the ones considered unnecessary were omitted and after adding one or two matters which were not mentioned in the first conclusion. I think perhaps the principal conclusion which was omitted was the one marked N° 7 B, that there is a concensus of opinion in favour of the width of the coping of the wall to the shed of 35 feet or possibly 40 ft. in certain places, as from what was said here and discussed by the Committee it was felt that this was not a question that could be laid down on general lines, that it varied so considerably in different places and under different circumstances, and therefore it was decided to make no recommendation with regard to that point. As the Chairman has suggested, perhaps in view of the fact that you have not got a copy of these resolutions I might read them again so that you may have them more clearly before you.

(Mr. Savile read the resolutions.)

The Chairman. — You have heard this proposed resolution read and I should be glad to invite any comments from any gentlemen who wishes to say anything on the general resolution. I do not know whether you would like to vote upon it right away, or whether you would prefer to go through it paragraph by paragraph

to give an opportunity to anyone raising a question on each paragraph before it is passed. I am in your hands, Gentlemen, as to what you wish. In the first place, I invite anyone who wishes to make any general remarks on the whole question to do so.

There being no remarks, I will ask you paragraph by paragraph whether you agree or whether you wish any verbal amendment in the paragraphs as we take them and then to vote on the whole. I think you will agree that we can leave out the preamble, which simply repeats the questions which are for discussion. The first paragraph reads as follows :

« 1° *That with regard to the probable future dimensions of ships there is a tendency, for economical reasons connected only with the cost of running, to a general increase in the draught, but that, although the percentage of ships drawing 30 ft. and over is likely to be greater, this increase will be limited by the facilities offered by the main canal routes and principal harbours of the world, which should tend to check this increase in draught.* »

Are you all agreed that that expresses your opinion on this subject of the future dimensions of ships ?

The motion was carried.

The Chairman. — The next is :

« 2° *That there will be an increase in the average tonnage, more especially in that of ships of from 5,000 to 8,000 tons, but not in the tonnage of the largest pre-war ship, in the very near future.* »

Are you in agreement with that ?

The motion was carried.

The Chairman. — Next :

« 3° *That the accommodation to be provided for ships should be guided by the consideration of true economy, and that, against any anticipated saving in the cost of running a ship due to increase in draught, the additional expenditure entailed at all ports at which such vessels will trade, entailing the necessary deepening of approach channels, berths, docks and wharf walls, locks, dry-docks, etc., must be taken into account, it having been*

shown that the cost of the provision of these facilities due to increased draught varies as the cube of the depth. »

Would anyone like to make any remarks on that paragraph ?

Dr. Cunningham. — I simply wish to suggest, if the Committee would let me, the insertion of the word « *approximately* » before the words « *cube of the depth* ». It conveys no reflection on Mr. Savile's admirable calculations if I indicate that there may be exceptional circumstances under which the law he has formulated may not hold good. I think it will come within Mr. Savile's and the general experience of other engineers here that there have been cases where a deepening may be effected at less cost than the original. I hope the Committee will see their way to accept the word « approximately ». It will not invalidate the general truth of the statement.

Mr. Savile. — I am quite prepared to accept the word « approximately. »

The Chairman. — Has any other gentlemen any remark to make ? If not, may I take it that paragraph N° 3 has your approval with the addition of the word « approximately », « varies approximately as the cube of the depth ».

The motion was carried.

The Chairman. — The next paragraph is :

« 4° *That the provision of the facilities for the rapid and economical discharge of goods on arrival at a port, is as important as the provision of deep water quays, etc., as the cost of handling goods in the large sheds and wide quays necessary to fill the larger deep draught ships to ensure quick despatch is an important item in cost.* »

I should like, to make one comment on that myself. I think the cost of collection and handling goods in large sheds applies equally to large ships of shallow draught as to ships of deep draught. I should say there « *the larger ships* ». It does not matter whether a ship is deep or shallow.

Mr. Savile. — I think I agree with you.

The Chairman. — I think it would be better that it should read : « *to fill large ships* » instead of « *to fill the larger deep draught ships* » so that it will read : « *necessary to fill large ships to ensure quick despatch.* »

The resolution was carried as amended.

The Chairman. — The next one reads :

« 5° *It may be useful in connection with an inland port, situated at a great distance from the sea, to construct a port of call for ocean liners near the coast, under the same administration as the inland port.* »

Has anyone any criticism to offer on that suggestion, or are you all agreed that the paragraph be inserted ?

The motion was carried.

The Chairman. — The next is :

« 6° *That with regard to new and recently constructed works, it is noticed that, in certain instances, 40 ft. of water has been provided for Atlantic liners, the depths provided for cargo vessels generally have been much more modest, and it is considered that as the trade of a port is and will continue to be largely dealt with in ships of moderate draught, the deep draught ships should pay proportionately greater harbour dues.* »

Interruption. — Is it 40 feet or 35 feet ?

The Chairman. — It is 40 ft. in the copy I have.

Mr. Savile. — This is simply a statement of fact, that in certain papers 40 ft. draught has been mentioned. In the next paragraph where the conclusions and recommendations come in we talk about 35 ft.

The Chairman. — To prevent any misunderstanding will you read that paragraph in French.

(The passage was read in French).

The Chairman. — Deep draught ships, from 35 to 40 ft. draught should pay higher dues than ships of 35 ft. draught because, as has been pointed out, to get the increased depth you cube your expenses or approximately cube your expenses. It has been suggested to me that whilst this is desirable from one point of view it has also to be borne in mind, and no doubt it would be borne in mind by the Sub-Committees which are proposed to be appointed in the different countries, that these big, these monster steamers like the *Leviathan* and the *Berengaria* do not pay extra dues especially with regard to their draught. But it does not do to forget that they have a very enormous tonnage on which the dues are collected. I do not know whether it would be desirable to say anything on that point, or leave that. No doubt the ship-owners who will be on the Committee of the different countries will have that point in mind because it is a very important one. I think we can leave that to be dealt with by the Sub-Committees. Now you have heard this paragraph read and translated into French : Is it your wish to agree to the wording of the paragraph as read ?

The resolution was carried.

The Chairman. — The next reads :

« 7° *That, except for the Atlantic passenger service, it is considered that, when everything is taken into account, it will be difficult to justify the necessity for a depth of water at the quay side of more than 35 feet at low water ordinary spring tides for many years to come ; while a port providing 30 feet of water at low water ordinary spring tides would be considered a first-class port.* »

Mr. Dodwell. — I merely rise to say, Sir, that it appears to me that the root of the whole subject now before this Section, is the question of draught ; that it seems desirable that there should be conferences between Naval Architects, who design ships, and harbour Engineers who design, provide and equip harbours for their accommodation, with a view of ascertaining whether the Naval Architects could so modify and adapt their principles of design, as to make it possible to meet the urgent presentday demand for increased tonnage of individual ships without a corresponding increase in their depth or draught.

When we contemplate the enormous expense of adding even a single foot to the available depth of a harbour, with its channels and approaches, to say nothing of the inevitable and concomitant increase in the vertical dimensions of its quay-walls, dock-walls, piers, wharves and so on, it obviously becomes a question of the greatest importance in the design of large vessels to determine whether or not it be possible to make their draught a reasonable and moderate constant-maximum, and augment their capacity — the product of length, beam and depth—by commensurate increase in length and beam. This, Sir, seems to me the root of the whole matter.

I am not prepared to say whether the adoption of my more or less crude suggestion would involve a radical and impracticable departure from the recognized principles of ship design, but if harbour Engineers are compelled to keep pace with the Naval Architects in their ever-increasing draught of large steamships we shall never reach a satisfactory and practical solution of the problem by which we are now confronted.

The Chairman. — Is there any naval architect here who would like to say something on this subject ?

Mr. Savile. — I am not a naval architect, but I might refer to one sentence out of one paper I wrote, in which I quoted from the Engineering Conference of 1907 where Sir William White said : « Now comes in a consideration of which we shall hear more before long. Having this great length and having this necessarily limited draught, we must expand in width and we can do so with very great advantage and without any penalty in cost of propulsion. » I think that answers your question.

The Chairman. — I am not a naval architect or a technical man but I should also like to say that the very first paragraph of this resolution states : « That although the percentage of ships drawing 30 ft. and over is likely to be greater, this increase will be limited by the facilities offered by the main canal routes and principal harbours of the world, which should tent to check this increase in draught. »

Distinctly there it lays down that the increase of draught cannot go on indefinitely calling upon harbours to increase their depth, but rather the builders of ships must cut their coat according to the cloth which they have provided for them in the shape of water where the ships can float. I think it is sufficiently guarded in that resolution.

Mr. Dodwell. — You can serve an injunction on the naval architect, that is all.

The Chairman. — The next is :

« 8° *The Congress proposes that these questions N*os *1 and 2 be referred to the next Congress and that in the meantime each nation should make an exhaustive study on this subject by the representatives of the various interests concerned, namely, ship-builders, ship-owners, Dock authorities and Dock engineers, as the want of this co-ordination in the past seems to have been a serious defect in port development.* »

Has anyone anything to say on that before I ask you to vote ?

Mr. Bowden. — I suggest that we should add to the last resolution a provision to the effect that it would be desirable for these questions to be studied also by the various Railways administrations, because nowadays so much depends upon the provision of adequate siding accommodation, marshalling yards, and other facilities for moving traffic; so much so that very close co-ordination is necessary in connection with these questions affecting harbours. In South Africa since we have become amalgamated under one management we have that co-ordination, the Port Goods Managers being railway men as well as dock men. Probably other countries would like to have provision made accordingly.

Sir John Biles. — I rise partly in answer to the question which Mr. Savile thinks he has answered in reference to the dimension which may be modified other than draught. It is a question which has been very thoroughly discussed even so far back as 1894. We cannot indefinitely increase beam ; if we do we shall indefini-

tely increase the stability and the motions of the ship at sea will not be good. We cannot indefinitely increase length because the depth of ship and beam remaining the same we get into the region of high stresses and uneconomical weight of structure. All these matters have been fully taken into account and the conclusion which has been reached is that you want a definite proportion of beam to depth, and a definite proportion of depth to length, and having got that proportion you may then proceed to study the question of the economic ship with an increase of dimension in all directions, including the increase of draught. I think that is the essence of the problem. I tried to set that out in a paper which has been printed and circulated to members of this Congress.

There is one other point I should like to mention. I called attention in that paper to the desirability of the whole of this question of the economics of shipping being dealt with as a research question. We are dealing with it here in a few hours and then we pass away to some years hence when it will again be dealt with. It is a question which cannot be dealt with in this way ; it must be dealt with in a systematic research method, and then civil engineers, dock engineers, shipbuilders and shipowners can have all their point represented and investigated. Until you do that thoroughly I am quite sure you will never reach a satisfactory solution because you will never have before you all the elements of the problem and all the solutions and equations into which these elements enter. I ask you again sincerely to consider this question whether in your recommendations of a Committee to consider this question you should not also include a recommendation for a Research Department in each country which should thoroughly investigate the question in detail, and support and educate that Sub-Committee to enable it to reach the best conclusions.

The Chairman. — I was going to ask Sir John Biles if he could suggest any amendment to this general recommendation which would embody his suggestion of research, whether some other body should be added to these bodies which are named. I take it that to the shipbuilders, shipowners, dock authorities and dock engineers you will agree to the addition of railway administration

as suggested by our friend from South-Africa. That is an important element and I take it we are all agreed as to that. But we want to suggest something definite and specific. This is a Committee consisting of various interests. Can we express in this by any addition of words what Sir John Biles suggests about further research ?

Sir John Biles. — I suggest that it should be an instruction from this Congress to the Sub-Committee that they should consider the question of creating a Research Department more completely to investigate these questions, leaving it to the Sub-Committee thoroughly to work out. It is quite impossible for this Congress to do any more than give its helping hand and say that it will be a good thing to do. That is as far as we can go at present.

The Chairman. — I will try and put that into words.

(The Chairman and Sir John Biles collaborated in formulating the desired resolution).

The Chairman. — We suggest the addition of these words to this general conclusion : « That it be an instruction to these Committee to consider the question of establishing systematic research into the whole question of the economic dimensions of ships and docks. » That would follow where the various people are mentioned and the conclusion would be the same as before. I will read the whole paragraph as it will appear if you agree to this addition :

« 8° *The Congress proposes that these questions N*os *I and 2 be referred to the next Congress and that in the meantime each nation should make an exhaustive study of this subject by the representatives of the various interests concerned, namely, shipbuilders, shipowners, dock authorities, dock engineers and railway administrations, and that it be an instruction to these Committees to consider the question of establishing systematic research into the whole question of the economic dimensions of ships and docks, as the want of co-ordination in the past seems to have been a serious defect in port development.* »

I dot not quite like that « serious defect in port development », If I had been drafting this myself I should have said : « as the want of co-ordination in the past has rather led to the development of ships and ports not proceeding *pari passu* ».

A Member. — « Not proceeding on economic lines ».

The Chairman. — I think that would be better. This is a reflection on the development of the ports. I will read the resolution once again :

« 8° *The Congress proposes that these questions Nos 1 and 2 be referred to the next Congress and that in the meantime each nation should make an exhaustive study of this subject by the representatives of the various interests concerned, namely, shipbuilders, shipowners, dock authorities, dock engineer and railway administrations, and that it be an instruction to these Committees to consider the question of establishing systematic research into the whole question of the economic dimensions of ships and docks, as the want of co-ordination in the past seems to have prevented the development of ports and ships on economic lines.* »

Has anyone any criticism or amendment to suggest to that ? If not I will put it to the meeting. Those in favour of this resolution which we have read out clause by clause will signify the same.

The motion was carried.

The Chairman. — That I think seems to conclude this afternoon's business as far as I know. But Captain Chambers has just given me a letter which he has asked me to read because he thinks it will be of great interest to this meeting, and after I have read it I will ask him to say a word on the subject.

This is a letter from the American Association of Port Authorities and it is dated June 21st, 1923, and addressed to Captain Chambers.

« Dear Sir,

» At a Meeting of the Executive Committee of the American » Association of Port Authorities, held in Montreal (Canada), » on June 12th, 1923, President M. P. Fennel appointed Captain

» F. T. Chambers and Dr. Brysson Cunningham and Mr. A. D. » Swan to constitute the Committee called for by the following » resolution :

» Whereas there has unquestionably been much progress made » in recent years in the science of port and harbour design and » planning and in the production of more efficient devices for » handling freight ; and

» Whereas the same cargo that is loaded into a ship at one port » must be taken out of that same ship at another port ; and

» Whereas there is but slight evidence of co-operation between » the designers of ports and port facilities in the different coun- » tries ; and

» Whereas it appears that there is an opportunity for substan- » tial economies in time and money if a more uniform design of » port facilities were created at the different ports ; and

» Whereas increased co-operation and interchange of thought » between the harbour authorities throughout the world will » promote the best interests of commerce ; and

» Whereas the ports of the world are the points of contact bet- » ween nations and the stabilising of international peace and pros- » perity ;

» Be it therefore resolved that the American Association of Port » Authorities is of opinion that an effort should be made to bring » about greater co-operation between those responsible for the » development of ports with a view to determining economies that » can be effected by greater uniformity in port design and equip- » ment , and

» Be it therefore resolved that the President shall appoint a » Committee from the Association with instructions that it commu- » nicate the substance of this resolution to the proper authorities » at the principal ports throughout the world, with a view to » determining how far international co-operation in design and » equipment can extend and the best methods of bringing this » about.

» Be it further resolved that this Committee shall report back » to the next Convention of the Association.

» The next Convention of the Association will be held in New » Orleans on December 10th, 11th and 12th.

» It is trusted that you will give the subject matter of the above » resolution prompt and serious consideration. »

Captain Chambers. — I came to London as one of the delegates from the United States and as a substitute member of the Executive Committee, but before I left Washington I received a letter from Mr. M. P. Fennell, the Manager of the Port of Montreal and the President of our American Association of Port Authorities, in which he asked me to represent the Association at this Congress, and I brought with me credentials which I presented to the Secretary of the Congress upon my arrival. I knew nothing of this proposal for international cooperation in port design and equipment when I left Washington, but I received it by mail at the hotel. As we say in the United States, « it is a large order », but it seems to me that it is absolutely on all fours with the subject we have before us now. It is almost the same thing as our questions N^os^ 1 and 2 of Section 2. It struck me, especially in view of the fact that Dr. Cunningham and I constitute a majority of this newly appointed Committee that we take the matter in our own hands and do as we like about it, and we both like the idea of obtaining the help of all you gentlemen. I cannot conceive a better time for this thing to arise than now. While it is a considerable piece of work to be accomplished by next December, at least we will start fair because if you gentlemen will assist me will cut out a good deal of Red Tape and shorten the time so that we may arrive somewhere. We are all working towards the same end, and what the American Association of Port Authorities works out in this matter will be just as beneficial to our International Association of Navigation Congresses. The American Association has the advantage of meeting every year. If we do not get through this thing by December we can make a Progress Report and perhaps get through by the following year. I have great hopes that with your co-operation we shall be able to report to the next International Congress some very valuable material. It seems necessary to prepare some sort of questionnaire and I am going to depend on Dr. Brysson Cunningham for part of that, and I think we ought to be able to start and I beg your indulgence and your help.

The Chairman. — I think what Captain Chambers has said is very interesting, but it occurred to me whilst he was speaking that he can do something better than he proposes. The machinery already exists in America. This resolution has been passed at Montreal and it is to be reported upon by December of this year. Captain Chambers suggested that he would be able to give the next meeting of this Congress the benefit of their investigations in America and their proposals, but I should like to suggest to him that long before this next Congress meets his facts and material will have been go together for the Meeting in December, and it would be desirable,therefore, that any suggestions they have to offer and any proposals they think of putting into operation might be communicated to the Central Association of this Congress and by it sent to the different countries so that the proposals being made in America this year will be before these Committees appointed in the different countries to investigate the matter. I think that might help to some conclusion at the next Congress. Is it possible to forward these suggestions earlier ?

Captain Chambers. — I think your suggestion, Sir, is an excellent one, but I still maintain that as we have you gentlemen present we can at least start you thinking on the subject, and I hope you will start your own people thinking about the subject and we shall collect that much information in advance. I see no reason why — and I think Dr. Cunningham will agree with me — the American Association of Port Authorities should not co-operate with the International. It occurs to me that no matter what the conclusions are which are reached by our American Association Meeting, even if they do not finish this year and only make a Progress Report and make a Final Report next year, there is just as good material for discussion before the Congress three years hence as though we put forward separate papers. I, therefore, suggest that you gentlemen should simply bear the message to your countries and bear in mind what has to be done and assist the good cause in every way that you can. We will get out the material for the benefit of all.

The Chairman. — We are much obliged to Captain Chambers

for doing that. That will now conclude the business on the programme for today but if you can wait for about ten minutes or a quarter of an hour Captain Harrold of the Royal Navy would like to address a few remarks to you on the subject of « Ship Signalling at Sea during Fog. »

(Captain Harrold read a short paper on the subject.)

The Chairman. — We are much obliged to Captain Harrold for his paper.

Adjoured to tomorrow (Wednesday) at 10 a.m.

SECOND SECTION

(Ocean Navigation)

FOURTH MEETING.

Wednesday, July 4th. 1923, morning

Sir Ernest GLOVER, Bart., in the chair.

The Meeting was called to order at 10 a. m.

The Chairman. — I am sorry to say that Mr. Deane, who was to have presented the Report on the papers which have been sent in on Question n° 3, is unable to be present this morning owing to illness. At very short notice, therefore, Dr. Isserlis has had to go through Mr. Dean's report, and he will give you a short statement of the report, dealing particularly with the question of : *the relative advantages of ship equipment and port equipment for loading and discharging ships*. The question we have to discuss this morning also includes mechanical equipment of ports, *mechanical handling of freight; and loading, discharging and carrying between ships and the various depositing points, whether covered by sheds or not*. It would seem to be sufficient to begin with at any rate, if we dealt with the first portion of the question, namely, the relative advantages of shipping equipment and port equipment for loading and discharging ships.

After Dr. Isserlis has made his statement, if it would be acceptable to you, it is proposed to have some slides shown on the screen, which indicate the process of loading and discharging cargo in various ports. These slides were recently shown at Sheffield by Dr. Cunningham, who has offered to show them to us here as furnishing visible information as to the problems we have to consider.

I will now ask Dr. Isserlis to give you a short summary of Mr. Deane's report.

Mr. Isserlis. — Mr. Deane separated the question into two parts.

As regards the first part, « the relative advantages of ship equipment for loading and discharging ships », he considers first, M. de Castro's Report 44. The author of this Report does not consider it desirable to rely on ship equipment and as a general rule prefers shore installations. He points out that ship equipment is advantageous when it is possible to load or discharge general cargoes into lighters lying alongside, and that the cost of working such equipment is low as it can be carried on by the ship's own crew.

MM. de Pélissot and Alexis, in Report 45, describe the type of ship equipment in which each hatch is served by two derricks and two winches with a common control They point out that operations by ship's gear are much slower than when modern quay cranes are used. They consider that 10 % of the traffic handled in French ports is dealt with by ship's gear. Ships gear is indispensable but is not the most practical when shore cranes are available. At the Joliette Dock, Marseilles, as much as 500 tons per annum per metre of quay has been handled by ships discharging cargo with their own gear into dummies or lighters.

M. Barrillon in Report 45 refers to the handling of coal by ships gear at Rouen during the war. In 1916 over 2,000,000 tons were discharged at 50 berths, the maximum rate per berth reaching 1,000 tons in 24 hours.

Dr. Brysson Cunningham in Report 46 points out that practically all ships are now fitted with cargo handling gear of various kinds. He gives a detailed description of the method know « Burtoning ». This method is rather quicker than the crane but the latter is generally more powerful.

Mr. Woods in Report 46 lays stress on the distinction between the Liner and the Tramp. In both cases there is overlapping in regard to appliances provided by ships and ports. Liners particularly have unnecessary working gear—75 % of such gear could be dispensed with on the Southampton to New York Liners. The

case of the Tramp is different as tramp owners recognise only one obstacle to the loading or discharging of cargo, viz., the limitation of water at the port concerned; the present tendency is to still further increase the cargo equipment on board tramps. He strongly advocates close co-operation between Shipowners and Ports Authorities as to what mechanical appliances should be provided. It is obviously a waste of money to provide full equipment for both ships and quay. On the whole he would encourage the devolopment of ship equipment.

Mr. Ellis, in Report 47 also presses the distinction between classes of ships employed and also that between classes of cargo. Bulk cargoes can only be efficiently handled by specially designed shore equipment. On certain trade routes cargo may have to be loaded or discharged where there is no equipment and ships engaged in these trades must be equiped with sufficient gear.

Mr. Mitchell in Report 47 is in agreement with a number of points in the previously summarised reports. Ships gear enables loading and discharging to be carried on on both sides simultaneously. It as a smaller range than quay cranes. There is little to choose in the matter of speed. He gives an instance of 20,400 tons discharged in 8 days from a ship equiped with 21,5 ton derricks and quickacting winches. He states that the fact that there are a large number of ports with no equipment on their deep-water quays and a still larger number with no deep-water quays at all, makes it evident that the vast majority of ships must be equipped for loading and discharging their own cargoes. He draws attention to the use of ships gear for breaking out cargo whereas the use of quay cranes for such purposes is prohibited.

Mr. Peace in Report 47 also draws attention to the advantage of ships gear for breaking out cargo.

M. Albertazzi in Report 48 gives a description of ship appliances in general and calls attention to the advantage of electro-hydraulic system. Ships cranes are more advantageous than ships derricks as they have greater efficiency, larger range and effect a saving in labour. They are, however more costly and cannot be used for warping purposes. He considers good ship equipment essential for bulk cargoes, but sums up in favour of good shore equipment as being alone capable of dealing with every requirement of traffic.

He advocates co-operation between Shipbuilders and Port constructors in order to obtain the best results.

MM. de Roode and Sprenger in Report 49 also describe « Burtoning » which they state requires rather more labour. Where the ports of call are not equipped with modern cargo handling appliances and in small coasting ports or little frequented places the advantage lies with ships gear.

Dr. Isserlis then read conclusions 1-7 of the General Report of Mr. Deane.

Dr. B. Cunningham then proceeded to show on the screen the slides to which the Chairman has alluded.

The Chairman. — I am sure we are all deeply indebted to Dr. Cunningham for his most interesting slides and his description of them. What we have seen, I think, gives us a very good foundation for carrying on our discussion on the question of shore equipment versus ship equipment. I think he has demonstrated that, in certain cases, shore equipment is not only desirable but absolutely essential. He has also shown us that some ship equipment at any rate is also necessary.

Mr. H. Mitchell. — Mr. Deane has drawn some very interesting conclusions from the papers, in regard to the majority of which I think, we shall all be more or less in agreement. There are, however, one or two points which I think might be looked into a little further before we deal whith the conclusions of this subject.

In the second Conclusion Mr. Deane says « For liners plying between definite bases or ports, shore equipment generally is to be preferred », and he goes on to say « for cargo steamers it is advisable, more particularly where fixed bases are not worked to, that they should be fully equipped with gear suitable for the trade in which they are engaged ». I want to suggest that instead of the word « advisable » the word « essential » should be used. As one of the authors of the papers remarks, it is an article of faith amongst shipowners that their boats should be able to go to any place where there is enough water for them to float. If they have to go to any place where there is enough water for them to

float, it is quite certain that for a great many years they will have to be equipped with gear in order to deal with any cargo which they want to land or ship at that place. Therefore, I think, with regard to cargo steamers it is essential that they should be fully equipped. There may be special cases in which that is not necessary, but generally speaking I believe it is essential that cargo steamers should be fully equipped. Whether the gear is used or not at all ports, is another matter, but it ought to be ready on board so that it can be used at any port where there is no shore gear to deal with her cargo.

With regard to conclusion 4, the General Conclusion from the Report is that it is only in exceptional cases you should have shore equipment. I myself would strongly advocate that in every port there should be some shore equipment, not only to supplement the work of the ships'gear, and, in the case of badly equipped ships, to assist them in discharging, but also to enable the port authority to form an opinion as to whether or not it would be sound policy for them to instal a full shore equipment, both from the point of view of economy and the quickness of despatch. I think at every port it will be found that some shore equipment for dealing direct with cargo from ship's holds is not only useful in supplementing the work of the ship's gear but also in enabling the port authority to arrive at the true conclusion as to what is the right policy to adopt.

The fifth Conclusion says « In ports where loading and discharging are carried out at moorings in the harbour, only sufficient cranes will be required for transfering goods between the quays and the lighters serving the ships. » I would suggest that the phrase « *only sufficient cranes* » is hardly strong enough. I consider that it should be laid down as an axiom that in ports where loading and discharging are carried out at moorings in the harbour there should be as many lifting points on the shore as there are discharging or loading points on the normal numberst ships working in the port. If you are to give quick despatch, you must be able to lift the cargo out of lighters as quickly as the ship can put it into them, or *vice versa*. There may be times of stress when you cannot quite comply with that, but you have your safety valve in the lighters, forming a reservoir for cargo afloat whilst you are

dealing with it ashore. In ports where loading and discharging are carried out at moorings in the harbour, I would suggest there should be as many lifting points or cranes on the shore as there are normal discharging points or loading points on the ships that are working in the port.

The Chairman. —M. Barrillon has the floor.

M. Barrillon (in French). — Mr. President, Gentlemen, in view of drawing the conclusions to be adopted by the 13th Congress on the 3rd Question of this section, and as reporter for France on « Mechanical equipment of ports », I should like to present a few brief observations in following the order of the conclusions proposed by the eminent General Reporter, Mr. Deane of the P. L. A.

3rd Conclusion. — The conclusion proposed under the n° 3 is drawn up as follows :

From the point of view of the ports, the determining factors (of the choice to be made between the equipment of ships and port equipment) seem to be :

a) The importance of trade and *b*) the depth of water which can perhaps be provided at the quays.

I think this enumeration should be completed by the mention of another factor which cannot be neglected in any question of equipment, namely the *nature* of the goods to be loaded or discharged.

This nature of the goods is even, to my mind, the *essential idea* of the problems of handling goods in ports, and I think if one wishes to formulate some precise conclusions in a like manner, one must *above all* distinguish the two following cases:

the handling of *various goods* on one hand and *heavy goods* on the other. Indeed, in a general manner, the same solutions may be considered as not applying to these two cases : not only is the material suitable for discharging « General Cargo » very different to that necessary, for handling large masses of heavy goods, but even the expediency of largely developing the public equipment of a port does not intrude itself, so forcibly. I conclude then that after the words « the importance of trade » to add « *and especially the nature of this trade.*

4th Conclusion. — The paragraph of the 4th conclusion proposed by the Reporter General is drawn up as follows : « ... but for the cargoes, the installation of an equipment (of a port) is only *necessary* if the ships are not equipped with gear. »

This formula seems to be very absolute more over, I do not perceive very exactly what could be the practical import of this conclusion with respect to the port administrations.

On one hand, indeed, ships already provided with gear have often an advantage to also use the equipment of the port in order to hasten their operations and it is even, perhaps, in the *simultaneous* use of ship's equipment and shore apparatus that we meet the most interesting examples of the use of ship gear. Now, in my opinion, the *rapidity* of discharging permitted by the use of port gear in place of or in addition to ship gear has become in our time a *necessity* of ocean trade. It cannot then be admitted that a ship being already equipped with a certain amount of gear, the equipment of a port « is no longer necessary ».

On the other hand, in the majority of cases, the port administrations could not know beforehand if the ships which will moor at a quay will or will not be powerfully re-equipped themselves so as to be independant of any port equipment; I believe then these administrations will act wisely, at least in the great maritime ports, in adopting on all public quays, without special distinction at least a minimum amount of equipment.

I shall conclude then, that the wording of the 2nd paragraph of the 4th conclusion proposed by M. Deane should be modified so as to present, as the general case in great maritime establishments the one where the port equipment is established and only as a particular case the one where the port equipment can be reduced. The new wording could then be as follows :

« For cargo boats, the port equipment must generally be deve-
» lopped in great maritime establishments. When most of the
» ships forming the clientele of a port are well equiped with dis-
» charging gear; the equipment of the port can be reduced in a
» certain measure. »

5th Conclusion. — The wording proposed is as follows : In ports where the loading and discharging are carried out at moorings in

the harbour, only sufficient cranes will be required for transferring goods between the quays and the lighters serving the ships.

I think that this wording does not exactly express the ideas of the Reporter General. Certainly the latter did not mean to consider as unimportant for the discharging of ships working with lighters, the use of machinery other than that of the ship's gear and the small shore cranes for lighters; it is then in consequence of a lapsus calami that the *floating cranes* are not explicitely mentioned in this conclusion.

I think however I should take up this emission because, in a very general manner, the engineers who compared the equipment of the port and the equipment of ships only considered the *short gear* as port equipment, and omitted in most cases to speak explicitly of *floating cranes;* now these machines may constitute in certain cases a very interesting and *very important* part of the discharging equipment of the port. It is then opportune that in the present conclusion we recall the role that floating cranes play. I point out to support this way of thinking the example of the Port of Rouen, in France, which discharges more than *8 millions of tons* of goods; in this port, which disposes of a total of 300 machines for handling freight nearly half of these machines, that is 23 cranes are floating cranes. These cranes can work on ships at moorings on dolphins.

The wording proposed by the Reporter General for the 5th conclusion should then be modified as follows :

« In the ports where loading and discharging are carried out at » moorings in the harbour, the equipment of the port can — » without the floating cranes — only permit of cranes suitable for » transhipping freight between the quays and the barges serv- » ing the ships. »

6th Conclusion. — The sixth conclusion presented by the Reporter General is the following : « Where a large percentage of the cargo is delivered into lighters overside by the ship's gear whilst being at the quays, the provision of shore equipment for unloading the larger vessels appears to be uneconomical ».

This wording appears to me to be too absolute.

Because a rather large proportion of the cargo must be directly transhiped on lighters, it does not however appear to me possible

to suppress all port equipment for the rest of the cargo indeed this practice would certainly delay the said ships to a great extent.

Indeed it is necessary, in order to reduce the stay of ships in ports to proceed *at the same time* with transhipment on lighters by the ship's gear, of the main part, of the cargo and to discharge the rest on land or on trucks by means of shore gear.

To state that a ship's equipment is not justified in this case, would be to ignore entirely the considerable profit which the *more rapid clearance* of out going ships and mooring room would represent both for the shipowner and the port administration.

Indeed in other respects, and precisely on account of the importance of the rapid clearance of ocean going ships several administrations of ports — where transhipment on lighters has been greatly developed — have considered it necessary to establish a port equipment. It is thus that at Rouen where an average of 2/3 of the cargoes are discharged directly on the barges the port authorities have nevertheless established shore equipment on all the public quays in use. On the other hand, it is certain that in a port where transhipment is carried on a great deal, that there can be *fewer* shore cranes than in the maritime establishments where all the cargoes are put on rail or on the platforms.

I believe than that the proposed wording for the 6th Conclusion could be advantageously modified as follows :

« When a large proportion of the cargoes is transhiped on » lighters by the ship's gear, the ships being alongside the quays, » the shore equipment for discharging ships can be less deve- » loped. »

7th Conclusion. — I think that the word « petrolium » should be suppressed in the enumeration of cargoes for which shore equipment is preferable to equipment on ships.

Indeed in the ports (like Rouen) where a liberal regulation permits maintaining in operation of the principal boilers of the tank-steamers, it often happens today that the discharge of petrolium by the ship's pumps is much more rapid than by shore equipment.

Conclusion 7 bis. — In the comparison established between ship and port equipment, I have had the opportunity of making conspicuous the twofold indirect advantage of a developed equipment both for the shipowners and the port administrations. This

aspect of the question seems to me to be important enough to to give rise to a conclusion.

This could be drawn up for instance as follows :

« In the comparison between the relative advantages of ship's » equipment and port equipment, we must take into account the » indirect profit which the shipowners obtain from a *more rapid* » *clearance* of their vessels, and what the port authorities obtain » from the increased *output of the quays*.

» For the last an increase of equipment may sometimes replace » an increase in the length of the quays, and the development of » mechanical gear for handling freight is most often the most » practicable means to meet a rapid increase of traffic.

I shall remind you in order to support this last part of the conclusion, that it is owing to a considerable development of their discharging equipment that the french ports were able to cope during the war, with a traffic of heavy freight *double that* of 1914.

With respect to the conclusions proposed by the Reporter General for the 2nd Part « Mechanical equipment etc... not yet discussed, I point out right now that it appears to me that the wording of the conclusion N° 16 needs modifying.

Indeed in a very general manner railway tracks are today laid down along the quay side in the new works of maritime establishments : when the direct discharging on trucks is not very considerable, the number of tracks along the quay side may, it is true, be reduced, but the complete suppression of these tracks, is not in my opinion to be recommended except in very special cases.

I do not then think it is possible to adopt a conclusion of which the wording seems to clearly indicate that the establishment of railway tracks on the quay side is not desirable in the majority of cases.

On the other hand, the importance of the provisions to be taken in the ports to permit the quays being rapidly cleared of the freight discharged, does not seem to me to be sufficiently demonstrated.

However experience shows that on the quays where the unloading gear is plentiful and up to date it is generally the means of *clearance* which are lacking, and which prevent these quays from rendering all the service which might be expected considering the development of their equipment.

This point is to my mind essential, with respect to the working of a maritime port and I consider it deserves to be recalled in the conclusions; it could then be under the following form :

« When a developed equipment has been established, it is often » the *means of clearance* which are wanting, and which in conse- » quence, limit the traffic; it is then essential that the improve- » ment of the means of clearance go on in *conjunction* with the » increase of equipment for discharging and handling goods. »

The Chairman. — M. Coen Cagli has the floor.

M. Coen Cagli (in French). — M. Barrillon spoke on a question which to my mind has not been sufficiently dealt with, that of the greatest use that quays can be put to, owing to their increased equipment. This is a very important question especially from the point of view of our Mediterranean ports, which for the most part are still unprovided with a sufficiently complete equipment. In Italy, we have come to the conclusion that in many cases, and especially under present conditions, it is preferable to equip the quays intensively, rather than increase their length. We have had the proof of the advantage of applying these principles by increasing the equipment of our principal ports, which increases the use of the quays to a considerable extent.

Formerly, we thought that in a regime of economical working, the average output of the quays was not to exceed 400 tons per metre and per year, whilst by the increase of the equipment we were able to attain exceptionally during the war more than 1000 tons per metre and per year. Therefore, the conclusion that it was possible to increase the output of the quays without increasing their equipment. The equipment of the quays has then been increased in Italy instead of the length. It seems to me that the conclusion of M. Barrillon has much importance and could be added to the conclusions of the Reporter General.

Mr. Laknisky. — I think in Conclusion 7 the word « grain » should be omitted. In the case of Russia, the grain is first of all stored in the interior and then it is brought to the sea by means of inland waterways. It is much simpler to transfer the grain from

the barge, especially by means of suction devices I think this Conclusion cannot apply to a country which exports a great amount of grain.

Mr. B. Cunningham. — I venture at this stage to suggest for the consideration of the Congress whether it would not be advisable to follow the excellent example set by the previous section and appoint a Sub-Committee to deal with these Conclusions. The Conclusions which have been laid down, by Mr. Deane, have necessarily been limited to the views put forward by the authors of the papers. Unfortunately one notices that, while of course there is a considerable amount of useful and very valuable information, yet glancing over the list of contributors, there is a very important omission ; there is no representative of the United States. That raises a point immediately in regard to Conclusion N° 2 : « From the point of view ofthe ship : for liners plying between definite bases or ports, shore equipment generally is to be preferred ». What are we to understand from that, seeing that there is no reference in any of the papers to the fact that shore equipment includes cargo masts ? They are part of the shed structure, and American authorities would undoubtedly claim that their system of handling by means of cargo masts has so much to commend it that it should be regarded as one form of shore equipment.

In laying down Conclusions for adoption by this Congress, we must bear in mind that they will be looked upon as official pronouncements Therefore, we have to proceed very cautiously as to the views which are expressed. A number of the papers give expression to opinions founded upon local considerations, and before we proceed further it seems to me desirable that we should have a Sub-Committee, similar to that appointed in regard to the previous question, to deal with the various views expressed and to cover the ground in a more catholic and universal way than has been possible on the basis of the papers submitted. You had represented to you, Sir, that the American Association, of Port Authorities yesterday sent a communication to their delegates in this country pointing out that it seems to the Americans that the goods dealt with on both sides of the Atlantic are the same class

of goods. They are goods that come under the heading of general merchandise, and, therefore, there should be some uniform system of dealing with them. But the Americans have a different system from ours, and we cannot do justice to the whole question unless we take the United States' view into consideration. Unfortunately that has not been covered by any of the papers submitted. I venture to express the hope that a Sub-Committee will be appointed to deal with the whole matter.

The Chairman. — I had it in mind to ask the meeting to appoint a Sub-Committee to try to draft a resolution which would be acceptable. I think a Sub-Committee should be appointed. I have not had an opportunity of reading these various reports, but there is one thing which does not seem to me to have been very strongly touched upon in these Conclusions. It was suggested just now by Mr. Cunningham. The problems of the different ports are essentially different. For instance, on the American sea-board one of the largest shipments is grain. In this country we do not ship grain; our task is to discharge the ship. So that the grain facilities to be put into operation in America are essentially different from what they are in this country. Again, as pointed out by Mr. Laknisky, the problem of shipping grain in Russia is entirely different from the problem of shipping grain in America. It is different, again, in Australia and in orther grain shipping ports. Very large numbers of small grain shipping ports have no such things as elevators, and it would never pay them to erect elevators. In many of those small ports grain is loaded from lighters, and, therefore, the ship must have gear for taking grain on board from lighters.

Then there is coal. Coal can be loaded quicker at Norfolk in America than it can be loaded in this country. They have more modern devices there. We can load coal pretty quickly on the Tyne and at Cardiff, and pretty cheaply; but we cannot discharge coal in Cardiff. If we want to discharge coal we have to go to Genoa or Port Said or Malta, where they have the facilities for discharging coal; but they cannot ship it. It is all a matter of the nature of the cargo to be handled, and not only that, but what is the main object of the particular port, Is it a port which ships

coal or is it a port which receives coal? The installations of shore equipment must be essentially different, according what the particular duties of the port are. That is a point which I should like the Committee to bear in mind when they draw up a resolution for submission to this meeting.

M. Rojdestvenski (in French). — In N° 2 of the conclusions of the Reporter General Mr. Deane, it is said : « From the point of view of the ships, shore equipment must generally be preferred for packet-boats plying between determined ports or sailing according to fixed routes ». That is quite true.

But as to the second part of the same paragraph, I cannot admit it. It goes on to say. « With respect to mercantile ships, it is recommended to provide them with complete equipment adequate to the traffic to which they are destined, more particularly when they have no fixed ports of call.

Such is the modern tendency. This part is not in conformity with paragraph 7 which says that « in the case of heavy cargoes in bulk, coal, grain, ore, petrolium, etc... shore equipment is much more preferable to ship equipment ».

Then there is again the case where shore equipment is preferable to ship equipment. Shore equipment is to be preferred when there is intense traffic in a port. That is why I propose to rectify paragraph 2 and to say, after the first part : « in the same way as for the cargo-ships in the case of heavy cargoes in bulk... » Besides for cargoes in bulk, the solution depends entirely on the distance between the port of shipment and the port of exportation, for in the case of long voyages, the ship's equipment will remain idle a long time.

Likewise the opportunity of equipping the determined points in the ports depends on the amount of freight which has to be handled at these points.

On the suggestion of the Chairman the Sub-Committee was composed of the following gentlemen :

Great Britain : Messrs. Mitchell, Brysson Cunningham and Deane.

France : M. Barrillon.
Italy : M. Coen Cagli.
United States of America : Captain Purdy.
Japan : Mr. Kizu.
Russia : Mr. Rojdestvenski.
South Africa : Mr. Bowden.
Denmark : Mr. Agerskov.
Belgium : M. Kinart.
Holland : M. Bos.
Sweden : Mr. Hörnell.

The Chairman. — I think before we separate it might be useful if we read through the Conclusions arrived at with regard to the next part of this question, mechanical equipment, etc. They are as follows :

8. *The aim should be to develop mechanical power in preference to extending manual labour and animal traction.*

9. *Electric power is, generally speaking, preferable to steam or hydraulic power but up to the present the development of the alternating current motor has not advanced sufficiently to supersede direct current, although economies in current consumption may be looked for in this direction.*

10. *The more diverse the character of the goods dealt with, the more difficult is the solution of the problem of handling.*

11. *Special classes of goods such as bulk cargoes and consignments in parcels of uniform weight and size can most effectively be dealt with by special machinery designed for the purpose. This applies not only to loading and unloading appliances but also to the transportation between quay, shed and waterhouse.*

12. *Mechanical equipment for sheds and warehouses may consist of overhead cranes for handling heavier packages or portable electric cranes as well as telphers, overhead runways, etc., according to the classes of goods to be dealt with. There is considerable scope for improvement in quayside appliances for handling general goods ex large cargo vessels.*

13. *Fixed sheer legs and heavy lift cranes as shore appliances are being superseded by floating pontoon cranes.*

14. *The handling of general cargoes between ship, shed and warehouse can most effectively be performed, when distances are considerable, by electric trucks or electric tractors with trailers ; in the case of short distances and where labour is cheap and effective, manual power is generally to be preferred.*

15. *Opinions differ considerably as to whether quays should be wide or narrow, but this question to a large extent must depend on the type of quay equipment most suitable for loading and discharging the ships using the quay.*

16. *The provision of railway lines on the quay front is desirable only where it is possible, as a general practice, to discharge direct into railway wagon.* »

There is a good deal of what we should call in this country « pious opinion » expressed in these Conclusions, but I hope the Committee will try to reduce them to a form in which we can speak upon them.

The Meeting adjourns to-morrow (Thursday) at 10 a.m.

SECOND SECTION

(Ocean Navigation)

FIFTH MEETING

Thursday, July 5th. 1923 (morning)

Sir Ernest GLOVER, Bart, in the Chair.

The Chairman. — I am sorry we were not able to begin earlier, but the drafting of the resolution to embody the views expressed yesterday has taken longer than was anticipated, as there as been a good deal of discussion upon it. I will read the proposed resolution to you in two or three minutes.

There is one point which I have been requested to bring before you in reference to the conclusions at which we arrived yesterday on Questions 1 and 2. We did discuss those conclusions very fully, and we went through each paragraph in detail and you agreed that they fairly represented our views. Paragraph I read :

« *1° That with regard to probable future dimensions of ships there is a tendency, for economic reasons connected only with the cost of running, for a general increase in the draught; but that, although the percentage of ships drawing 30 feet and over is likely to be greater, this increase will be limited by the facilities offered by the main canal routes and principal harbours of the world which should tend to check this increase in draught.* »

The representatives of the Suez Canal consider that, in referring to the canal routes, we rather ignore the development of the Suez Canal. The Suez Canal Company inform me that they are prepared to go on deepening the Canal to any extent that may be necessary to keep pace with the increased draught of ships. They suggest that instead of the words : « main canal routes and

principal harbours of the world », the words : « the principal maritime works » should be inserted.

I see no objection to making it read : « the facilities offered by the principal maritime works of the world ».

Is it your pleasure that we should make that alteration ?

M. Perrier (in French). — M. Quellennec, first delegate of the Suez Canal Company regrets he is not able to be present at the meeting this morning.

As a former engineer of this company and the commission of works, I have intervened to transmit the observations of our colleague M. Quellennec.

Mr. President, I think the intentions of the Suez Canal Company are sufficiently well known to us. The Company desires to deepen the canal so as to clear it of all obstacles to navigation and to always meet the requirements of navigation created by the increase in the size of ships. I had the opportunity of saying in 1912 at Washington, that the Company would always do its utmost to pursue that policy.

I believe it is useless to read the report of M. Quellennec. I think it is sufficiently well known.

The Chairman. — If you prefer it, we could simply leave out the words : « main canal routes », « maritime works » does not appeal to me as happy expression. Would it meet your point, M. Perrier, if we simply struck out the words : « main canal routes »

M. Perrier. — Yes.

The Chairman. — Then in that paragraph we will omit the words : « *main canal routes* » and it will simply remain : « *by the principal harbours of the world* ». That is to say, the draught of the ships must necessarily be limited by the draught of the principal harbours of the world. Is it your pleasure that we put forward that alteration ?

Agreed to.

The Chairman. — Coming to the question of **the relative advantages of ship equipment for loading and discharging ships,** the conclusion which has been arrived at reads as follows :

« *In most cases it is preferable to use port equipment for the handling of bulk cargoes. Speaking generally, port equipment is, from the point of view of efficiency, preferable to ship equipment. It appears to us essential, however, that all ships should be supplied with equipment adequate for their usual trade, but in the case of ships trading regularly between ports furnished with a very complete equipment, the equipment of the ship may be reduced.* »

I shall be glad to hear any comments on this proposed conclusion.

Captain Purdy. — I agree with the proposed conclusion, except the last sentence which reads :

« *but in the case of ships trading regularly between ports furnished with a very complete equipment, the equipment of the ship may be reduced.* »

I think the Congress should consider carefully before it makes a recommendation that the ship's gear may be reduced. If ships were only concerned with the ports, such a recommendation could easily be made, but, unfortunately, ships are concerned with the sea and with the perils of the deep. A liner is as apt to be aground as a tramp, and in cases of grounding and stranding ship gear is essential for salving operations. This would also undoubtedly have a marked effect on the insurance. I threrefore beg to propose as an amendment that, following the sentence which says the equipment of the ship may be reduced, the following words should be added :

« However, ship's gear should always be sufficient to handle cargo in case of emergency. »

If you look back over the records you will find that there is hardly a month goes by but that some ships are salved by being partially or entirely salved with the use of their own gear. I think we should consider very carefully before we encourage ship designers to omit the necessary gear to enable a vessel to care for herself when she is stranded.

A Delegate. — It is not only in cases of stranding where a ship's gear is useful, but in cases of shifting cargoes. A cargo may be found to be improperly stowed in the vessel, and under those circumstances, it may be very necessary to do some handling, in which case you would require ship's gear.

Captain Clark. — As an old sailor I wish to confirm what the two previous speakers have said. I have known of cases of cargo shifting and having to be handled by the ship's gear.

M. Cagli. — The remarks made just now, do not seem to be exactly right. The resolution does not say that in these cases ship equipment must be abandoned, but that it can be reduced. If the ship must do the loading and discharging, it must then be equipped with an improved apparatus. But in the case where ships only ply between determined ports, their equipment can be reduced. The proposed conclusions do not mean that all ship equipment should be abolished, they mean simply that the equipment *can be* not *must* be reduced.

Mr. Bowden. — I think there is another very good reason for adopting the suggestion made by Captain Purdy about ships being equipped with sufficient gear. Sometimes the ports are very crowded, and ships which, in the ordinary normal conditions of business might get a berth, possibly would have to lie out in the road-stead or in the bay, and discharging with their own gear into lighters, because they cannot get a berth. The same type of vessel, plying along the coast and going to several ports would also require her gear at one port — say Port Elizabeth — but would not require it at a port like Durban she would have the use of the shore facilities. The tendency in connection with the latest cargo boats is undoubtedly to provide them with good and sufficient gear, notwithstanding the fact that they are plying between ports where there are shore facilities — for the reasons I have stated.

Mr. Deane. — I have much pleasure in supporting the resolution, for this reason — that it embodies the whole of the essentials

of cargo handling under these particular circumstances. I do not conceive that this resolution is intended to deal with any questions of emergency as they are determined, to a large extent, by the route followed by the ship and by other circumstances. The question as to what provision should be made for such cases of emergency is surely one to be decided by the ship-owners and by the ship constructors. The matter, of course, is also determined to a large extent by the opinions of such undertakings as Lloyds and other Insurance concerns. I quite appreciate the remarks made by the various speakers in regard to the provision of sufficient equipment to handle cargo in cases of emergency, but I do not think it alters the position in any shape or form. What we are asked to decide is whether the ship should be fully equipped for rapid handling of cargo or not. I think the resolution covers everything very amply. The resolution does not suggest for a moment that all ship equipment should be dispensed with. Such a suggestion would be absurd and I do not think any ship-owner builder or designer would ever think of following out such a suggestion if it were made. I have much pleasure therefore in supporting the resolution without the amendment.

A delegate. — In order to meet both sides, would it not be sufficient to make the last sentence read :

« that the ship equipment may, as far as the port is concerned, be reduced. »

Captain Purdy. — If that is offered as an amendment, I withdraw my amendment. That covers the point I want to make, exactly.

Sir John Biles. — Why not omit altogether any reference to reducing the equipment of a ship and leave it to the shipowners to draw their own deductions from the decision of the Congress given in the early part of the resolution ?

Mr. Deane. — I think that suggestion would meet the case absolutely, so far as the port is concerned.

The Chairman. — That would involve the second part of the resolution reading as follows :

« Speaking generally, port equipment is, from the point of view of efficiency, preferable to ship equipment. It appears to us essential, however, that all ships should be supplied with equipment adequate for their usual trade. »

M. Coen Cagli. — That is all right.

The Chairman. — Are you satisfied with that, Mr. Deane ?

Mr. Deane. — Yes.

The Chairman. — There is a slight misunderstanding. Mr. Cagli did not understand that we propose to strike out the whole of the last part and he suggests another alteration in the wording as follows :

« but in the case of ships trading regularly between ports furnished with a very complete equipment, the equipment of the ship, from the point of view of operations in the port, may be reduced. »

Mr. Hörnell. — Could not the second sentence of the paragraph be made to read like this :

« Speaking generally, port equipment is, from the point of view of efficiency, preferable to ship equipment, but it should be left to the ship-owners and the naval architects to decide in each special case what equipment on board is necessary in order to meet emergencies and conditions in harbours with incomplete equipment. »

I think that would cover the point.

The Chairman. — Mr. Hörnell proposes to leave it to the ship-owner to decide how much equipment is necessary for cases of emergency or for cases of ports with incomplete equipment. My own opinion is that the ship-owners will necessarily do that without our suggesting to them that they should do so. I think what we want, as a Congress, to do is to express a general opinion as

to what we think is desirable, and leave the details to the ship-builder, the ship-owner and the naval architect to work out according to what the ship is intended to do and the port she is intended to trade to. The question, I think, is simply now one of detail—whether we leave out all reference to reducing the gear or whether we suggest that a reduction may be possible in so far as concerns the operations of the ship in port.

I think perhaps the best way I can deal with it is to put to you first the section as sketched, with the addition of the words :

« from the point of view of operations in the port ».

Then, having taken a vote on that, I will ask you to vote on the question of whether we should drop out entirely the last part of the sentence and eliminate all question of reduction.

The first point I will ask you to vote upon is whether you approve of the wording :

« It appears to us essential, however, that all ships should be supplied with equipment adequate for their usual trade, but in the case of ships trading regularly between ports furnished with a very complete equipment, the equipment of the ship, from the point of view of operations in the port, may be reduced. »

That is the one alternative. The other is that we stop short and say nothing about reduction, in which case the paragraph would read :

« *It appears to us essential, however, that all ships should be supplied with equipment adequate for their usual trade.* »

(The two alternatives were then put to the vote, and the second one was carried.)

The Chairman. — Now, as a matter of propriety I think I should ask you to vote on the whole conclusion. I will read it again :

« *In most cases it is preferable to use port equipment for the handling of bulk cargo. Speaking generally, port equipment is, from the point of view of efficiency, preferable to ship equipment. It appears to us essential, however, that all ships should be supplied with equipment adequate for their usual trade.* »

(The conclusion was then put and agreed to.)

The Chairman. — Now we come to the second part of this question, **the mechanical equipment of ports; the mechanical handling of freight, and loading, discharge and carrying between ships and the various depositing points wheter covered by sheds or not.**

I think before we make any suggestion as to what we shall say on this, we might ask Mr. Deane to make a few remarks.

Mr. Deane. — Gentlemen, first of all, I must beg you to accept my humble apologies for not being able to be present yesterday morning, owing to illness.

I understand that the conclusions which I have given in my Report were read yesterday but, with your indulgence, I will read them again today.

(Mr. Deane reads the conclusions.)

I dare say the members will have a great deal to say on this subject. It is a vast question, and one in regard to which there must be many opinions as to what is the right type of equipment under various circumstances.

You will excuse me from saying very much on this matter at the present juncture, because these conclusions have been drawn from a careful perusal of the papers submitted, and they coincide with my own opinions almost entirely. The subject of electrical power as opposed to any other type of power, such as hydraulic or steam, is one which no doubt will raise a good deal of controversy I would suggest that when discussing the question of electric versus hydraulic power one should bear in mind the possibility of utilising the former in the immediate vicinity of the discharging or loading machinery for generating hydraulic power for transmission by the Hele-Shaw or other similar oil transmission gear. There is in my opinion great scope for this.

The question of the diversity of the character of the goods handled is one of such importance and the provision of adequate appliances for handling cargoes must, to a very large extent, be governed by the individual requirements of the particular part. For instance, at the Port of London there are some sheds on the North side of the new King George dock which, on the upper floors, are equipped with underhung travelling cranes. These cranes can reach from the quay right through the shed to the

back, where they can discharge into van or railway wagon. You can quite imagine that those cranes would be of little value in the case of small packages which can be handled much more readily by ordinary hand truck, but at the present time in one of those sheds we have been obliged, on account of insufficient storage elsewhere to pile a large quantity of tobacco. These cranes have been invaluable. They have enabled us to pile hogsheads of tobacco two high with the greatest of ease, and we can pick up any hogshead and send it to the consignee at any time without any difficulty whatever. You can imagine the difficulty we would have had in using the top floor efficiently for the storage of tobacco if we had not had those cranes.

On the subject of fixed port equipment, such as sheer legs and the like, one has only to visit some of the older ports to see the number of sheer legs that were installed (many years ago no doubt) which have the great disadvantage that they cannot be moved about to meet the requirements of vessels lying at an other quay. The importance of having movable sheer legs or cranes has been made manifest in recent years by the growth in the size of vessels. In the olden days it was a very simple process to move the small ships where the sheer legs were situated. Today moving a vessel of 12,000 tons and upwards is a very much bigger task. Therefore, the importance of having floating derricks or cranes is very evident.

In regard to the question of the width of the quay, I saw a report in the paper yesterday of another Section of this Congress having made up its mind that the width of the quay should be 30 or 40 feet. If this Section accepts that position, it has eliminated one of the factors which might tend to govern its conclusions. If you decide on a 30 or 40 ft. quay, it is very obvious that you cannot expect to handle cargo satisfactorily by such a gear as has been provided in certain ports with narrow quays. It is obvious that bracket cranes on the warehouses will not handle the goods that are deposited immediately over-side from the ship. You will have to provide portable cranes, or semi-portable cranes which are capable of dealing with the cargo either ex ship or from the ship's deck or from the side of the ship, depositing it

at any part on the 30 or 40 ft. of quay, or on the veranda of your shed.

Mr. V. E. Laknisky. — I desire to refer to three of the Conclusions. I propose to omit Conclusion n° 10, which does not give any direct indication as to the solution of the problem.

In regard to Conclusion n° 15, I think it depends on the *character of the cargo and on the character of the transportation.*

In regard to Conclusion n° 8, the substitution of manual labour by mechanical power in cargo handling, as well as in all other work, is not merely a question of « aim », as is mentioned, but it is a direct consequence of technical and economical factors which are of interest in the questions dealt with by the Congress of Navigation.

A simple expression of the influence of these factors in the problem of mechanical equipment can be given by the following formula

$$\frac{B + C + R + M}{Q} \lessgtr \frac{A + X + Y}{a}$$, where

A = is wages per man and per day.

a = efficiency of a worker in a day;

B = first cost of mechanical device taken in a given case;

C = yearly amount of amortisation of this cost of a mechanical device for a certain period of its service;

R = cost of running the device during a year, including wages of men, fuel, oil, etc.;

M = costs of maintenance and repairs during a year;

Q = amount of cargo handled by a given device during a year's time.

X = saving in cost of handling cargo due to the shortening of a quay line by applying mechanical power instead of manual labour.

It can be found thus :

X = Z (L-I) = ZDL where Z is the first cost of a running foot of quay; L and I are the length of a quay line in case of manual labour and in case of mechanical power.

Y equals saving in cost of handling cargo, due to the shortening of the laying time of ships in the harbour by applying

mechanical power instead of manual labour; it can be found Y = D (T-t) xf, where D is the mean net tonnage of ships, T and t are time of laying of a ship in harbour in case of manual labour and in case of mechanical power in handling cargo;

f = is the amount of harbour dues paid by a ship for each ton for a day of laying in harbour.

In order to bring the solution of the economical problem of mechanical equipment on a fundamental and scientific basis it is necessary :

1° To use as much as possible the data of existing practice, gathering them from all ports and checking all local conditions;

2° In order to enable comparison of these data — to have in harbours uniform statistics of all factors which characterise the handling of cargo and are expressed in the formula mentioned above.

Sir John Biles. — In this atmosphere of repression of the ambitions of a naval architect, I am glad to receive from Mr. Deane some encouragement. One of the difficulties in the pushing forward of big ships, apart from the commercial difficulties of increasing costs of docks, is the rate of handling cargo. It has been pointed out that that difficulty is a drawback to increased sizes of ships. Mr. Laknisky's formula (which no doubt the younger men followed with facility, but which I have not absorbed completely) may offer a complete solution of the whole question; but, subject to that, I am very glad to see that Mr. Deane says there is considerable scope for improvement in quay-side appliances for handling general cargo goods ex large cargo vessels. So that while the ardour of making bigger cargo vessels is damped to some extent by the considerations which were put forward yesterday, yet we have in this Section of the Congress some encouragement that in the future we shall have what we do really want, namely, more rapid facilities for handling cargo so that the turn-round may be reduced and the ship be kept at sea employed in her proper function of transportation of cargo. If I may be allowed in that connection to make one remark, it is that I think we have been rather frightened by the reference to

the increased cost of docks in proportion to their increased depth. We are told that the cost increases as the cube of the depth. As some kind of consolation to those who have the responsibility of finding the money, I may say that the big ship-owner is in just the same predicament. When you carry out, what you must carry out in increasing the dimensions, namely, continuing the same proportions of length to draught and breadth to draught, the increased cost of the ship is in proportion to the cube of the draught, so that the dock-owner and the ship-owner are in the same sort of difficulty. They have gone along side by side through the years that are past, and I do not think the bogey of cost varying with the cube of the draught will frighten them in the future.

Mr. A. R. T. Woods. — In supporting Mr. Deane in everything he has said in connection with this second point, I should like to make one remark. We have decided that it is necessary to have better equipment for ships, and also to see in the future that the quay is better supplied. There is no doubt that these two points are most essential for the rapid loading and discharging of ships, but if and when you do acquire these facilities there is yet another point to be considered, which I think has not been mentioned up to the present moment, and that is the congested state of quays in busy times. If you have facilities for loading and discharging ships quickly, they are of very little value, if the quay is so congested after a few days work that the discharging has to be stopped. There is one point in this connection that I should like to mention. I think if authorities, in busy times, could be persuaded to get consignees to take delivery of their cargoes quickly, and also if the time that is at present allowed by various authorities was reduced, say 50 %, the capacity of the ports could be doubled where delay was due to quay congestion. I respectfully submit that this might be taken up by some of the gentlemen here who probably have appreciated the difficulties in this connection. I know in one place abroad they have periodical congestions of the port due to the fact that the consignee when his cargo arrives leaves it in the Custom House sheds as long as he pleases, merely paying the warehouse dues. He is under no

necessity to withdraw the cargo out of the Customs as long as he pays the warehouse rent, until the market has improved, and then once the dues have been paid the time of removal is specified. If you take that sort of thing to its logical conclusion, any port could be congested in a week if all the consignees agreed not to move their cargo.

Further in connection with the same matter, adequate facilities to remove the cargoes from quays should be provided both by road and rail. Take London as an example, if there is anything more disgraceful than the lack of proper provisions in the above respects, it would be difficult to find. Therefore, when any extension or improvement in dock accommodation is contemplated the promotors should see that plenty of road and rail facilities are provided so as to make the scheme a success.

Mr. H. H. C. Mitchell. — With regard to the question of clearing goods from ports, I quite recognise the difficulties of the Port Authorities, but there is also the point of view of the consignee to be taken into account. He may not only be waiting for a market, but he may also not be in a position to find the necessary funds with which to obtain his documents to clear his goods. That very often happens in certain ports. I would suggest that in those cases it is advisable to have warehouse to which such goods can be moved — overflow warehouse or transfer sheds. Probably the consignee would be prepared to pay quite a handsome sum for such warehousing until either the market improves or until he can so adjust his financial arrangements as to enable him to get his documents and clear his goods.

With regard to the point as to which power it is preferable to use as far as cranes and plant of that description are concerned, it is probably a debatable point whether electric power, or hydraulic power, or steam power, or internal combustion engines, either in conjunction with electric power or possibly by themselves, are best for working the cranes. It does seem to me, however, that for overhead runways, conveyors, telphers, and all such appliances in and around a port, electric power is essential. It is the only power which is at present available by which one can really develop internal mechanical handling appliances. Of

course, there are plenty of exceptions, but, generally speaking, electric power is essential for such mechanical handling appliances.

I think everybody will be agreed that floating cranes, if the port is suitable for them, as most ports are, are preferable to shore cranes. In smaller ports there is sometimes a difficulty, especially where there are no docks and where the port is practically a roadstead, in finding a place where the crane can safely be kept in bad weather. There may be a swell in the harbour, and it is difficult to find safe moorings for the big cranes; but, speaking generally, there is no doubt in my mind that floating cranes are infinitely preferable to shore cranes for heavy lifts.

There are several points in these Conclusions, but the only other one on which I will say anything is the one that reads :

« *The provision of railway lines on the quay front is desirable only where it is possible, as a general practice, to discharge directly into railway wagons.* »

In my view, there should always be railway lines on the quay front, other than in exceptional cases. In my own experience, we omitted railway lines on the front, because we thought we would be able to do without them, but within about 3 months we had to put in a temporary line in order to discharge a steamer, and we would have done much better to have put in a permanent line right away. So that I should say the rule should be that there should be railway lines installed, except in exceptional cases.

Mr. A. H. Roberts. — Mr. Deane said that a resolution had been adopted by this Section with regard to the width of the quay.

Mr. Deane. — Not by this Section, but by the inland navigation one.

Mr. Roberts. — I have attended these meetings regularly, and have spoken on this subject of the width of quay, and I was not aware that any resolution had been arrived at. I am rather anx-

ious to know what we are doing in regard to any resolution on the width of quays.

Mr. Deane. — I was only referring to a report which I saw.

Mr. Roberts. — It is a pity if another Section has adopted a resolution on the matter if it is at all inconsistent with what we are doing here. I should like to support what Mr. Mitchell has said about these two last items, especially Item 16, and I would suggest we leave out the word « only » in the last section.

The Chairman. — We are not proposing to adopt these Conclusions absolutely as they stand. We are proposing to found a resolution on the strength of them.

Mr. Roberts. — Then I will leave it at that : supporting Mr. Mitchell's observations.

The Chairman. — The discussion which has taken place emphasises the difficulty of specifying any definite laying down of rules or suggestions for ports generally. We are very much indebted to Mr. Laknisky for his most interesting description on the blackboard, which only goes to confirm the extraordinary complications which arise in a question of this sort.

I have tried to put down a suggestion for you to consider as to what our conclusion should be. I have submitted it to Mr. Deane, and I think he is in general agreement that it more or less expresses the feeling of this meeting. It is as follows :

« The problem of mechanical equipment of ports for handling » of freight, etc. raises too many questions to be dealt with in » general terms. It is evident that where mechanical equipment » can be economically installed, it is desirable that this » should be done as leading to quicker and thus more economical » handling of cargo. The details of such mechanical equipment » must necessarily depend upon the needs and possibilities of » each individual port. »

That seems to me express as concisely as I can do it the general views which have been expressed.

Would anyone like to make a remark on this draft conclusion ?

Mr. Laknisky. — I think the question of mechanical handling is so complicated that it would be really useful to have statistics and data collected and considered in regard to the matter.

The Chairman. — Mr. Laknisky's suggestion, as I understand it, is that the different ports which have established mechanical equipment, or do establish mechanical equipment, should keep statistics and records and data of their equipment, which should be made available for other authorities who are thinking of establishing such equipment.

Mr. Laknisky. — And it is necessary to elaborate those statistics.

The Chairman. — But who is to do that? Each port must work them out for themselves. I do not think we can undertake, on behalf of this Congress, to collect and elaborate and tabulate and unify statistics. I think we may reasonably ask the ports which have mechanical equipment to furnish data with regard to their equipment to other ports, but I do not think we can undertake to collect and tabulate such statistics.

Mr. Deane. — One of the difficulties in collecting data of this description is to get them on a uniform basis. We have various types of machines, and they all have different characteristics, or a good many of them, and the difficulty is to get, even for ones own purposes, down to some reasonable basis, so that the performance of one machine can be compared with another. If you apply such principles to the whole world I am afraid the complications would be unsurmontable. But if I could voice the opinion of the majority of the big ports I would say that they would always be willing to place at the disposal of any other ports or their representatives any information they can in regard to mechanical equipment which they have installed. I am sure, so far as London is concerned, we should be glad to show what we have to any people who are interested.

The Chairman. — I think it is unnecessary to add it to the Con-

clusion, but I have just jotted it down in view of Mr. Laknisky's suggestion : « That those ports which have established mecha- » nical outfit should be invited to furnish data of their experience » for the benefit of other ports contemplating such installations. »

Mr. Deane. — Leave it to the ports. I think they will do that.

The Chairman. — Has anyone else anything to say on this Conclusion :

« *The problem of mechanical equipment of ports for handling* » *of freight, etc.* » I think that can be elaborated with the title of this question « *raises too many questions to be dealt with in* » *general terms. It is evident that where mechanical equipment* » *can be economically installed it is desirable that this should* » *be done as leading to quicker and thus more economical hand-* » *ling of cargo. The details of such mechanical equipment must* » *necessarily depend upon the needs and the possibilities of each* » *individual port.* »

The Conclusion was then put and carried.

Adjourned to 2.30 p.m.

SECOND SECTION

(Ocean Navigation)

SIXTH MEETING

Thursday, July 5th, 1923 (afternoon)

Sir Ernest GLOVER, Bart. in the Chair.

Communication N° 1. — **Concrete and reinforced concrete. Their applications to hydraulic works; means to insure their preservation and their watertightness.**

This Communication has been dealt with by Messrs Derycke, Haché and Goossens (Belgium) ; Munch-Petersen (Denmark) ; Voisin (France) ; Carothers, Mitchell, Cleaver, Mitchell Moncrieff and Sir Robert Hadfield (Great Britain) ; Aki and Okabe (Japan) ; Ringers and Tellegen (Holland) ; Becerra, Maese y Pena, Delgado Brackenbury and de Castro (Spain) and Petterson (Sweden).

The Chairman. — Before asking Mr. Humphreys to read his General Report, on concrete and reinforced concrete, I wish to point out, that there are on the table a certain number of copies of a pamplet of Professor Coen Cagli relating to the different type of modern moles.

I shall now ask Mr. Humphreys kindly to read his General Report.

M. C. W. Humphreys. — I should like to say, before I refer to the papers at all, how deeply conscious I am of the honour that has been done me in asking me to make a Report upon 14 such

competent Reports as we have received from so many distinguished Engineers, not only in this country but in those other countries the representatives of which we are so glad to see here to-day. I can assure you, gentlemen, that in making this Report it has been a real labour of love.

Mr. Goossens, one of the authors of the Belgian report, pointed out to me that on page 40 of the report, I have described the quay wall at Termond as being made of sheet piling for the whole of the depth. In that I must confess to an error It is not sheet piling to the whole of the depth, the upper four metres is a reinforced concrete wall.

I also notice that the word « bold » which I have used has been put into French by means of the word « hardi ». There is a shade of meaning in the word « hardi » which is not found in the word « bold » and vice versa, and in using the term « bold » I by no means meant to infer that it was a « construction hardie ».

Mr. Poulsen, one of the authors of the Paper from Denmark, also points out that, in connection with the experiments for determining the effects of puzzolanic additions to cement I have not brought out sufficiently well the results of the experiments which are fully described in his Paper and which have been made with mortars. Mr. Poulsen wishes to alter the terms of the General Conclusions. I had the advantage of seeing him two or three days ago, and I have put into English and French the modification he suggests of conclusion n° 4. It is as follows :

« 4.— a) *For works of concrete in sea water, puzzolanic additions to Portland Cement are to be recommended.*

b). — *Careful experiments should be undertaken to discover accelerated methods of testing the effect of puzzolanic additions to Portland cement mortars or concretes.* »

I have tried in the General Conclusions to do justice to that side of the question. You will see from the Paper that has been circulated that Mr. Poulsen desires to place it on record that the addition of such compounds is to be recommended. I do not go quite as far as that. I have put it in these words : « *That the use of puzzolanic additions to the matrix or aggregate should be exhaustively considered.* »

Mr Humphreys then gave a general summary of the Report and read the Conclusions.

M. Voisin (in French). — I ask permission to offer a few short explanations about the interesting General report of Mr. Humphreys.

I should like in fact to try to dispel certain misunderstandings which might result from the reading of the french translation of this report.

It is particularly said at page 8 « that the use of ordinary concrete for works on the coast was not made the object of a single discussion in France », on page 25 « that the conservation which the French engineer, has manifested up to now, is on the decline » and that « the technical world will welcome the arrival of the last recruit among the engineers who have advocated the employment of concrete, for all kinds of hydraulic works. »

At the mere reading of these statements, one could believe that the French engineers are not so progressive as their foreign colleagues.

This observation should be taken into consideration in a certain measure at least for the use of ordinary concrete. But thus as I have indicated and which Mr. Humphreys has repeated that arises from the fact, that until recently, the French engineers had at their disposal on account of the natural resources of their country, the means of creating in economical conditions, which are very acceptable, works constructed of masonry on the good conception and execution of which, Mr. Humphreys has given such a favourable report, so much the more valuable as it emanates from a perfectly competent personality.

But to-day, the situation is completely transformed, owing to the great changes which have arisen in the economic situation and the increasing difficulty of finding enough capable workmen.

That is why the application of concrete in maritime works — for it is especially from this point of view and not with respect to the use of concrete in fresh water, that my report was drawn up — is relatively recent in France.

That does not signify that the French engineers are timid in the

matter, and the best proof I can give of their courage is that quite recently, they have not hesitated to propose the use of ordinary concrete for the construction of new tidal quays for the outer harbour of Havre, which must have 12 metres of water alongside at lowest sea-level.

But the French engineers consider — and I have thought it necessary to insist on this point — that great precaution must be taken as much for the nature of the material forming the concrete, as for the way in which it is used, for there is there in their opinion, considerations of great importance of the works.

This stated, although being on the whole completely in agreement with Mr Humphreys on his conclusions, I think however, I ought to to suggest that some of them, of which the character seems a little too absolute, would benefit by being slightly modified, from the international point of view.

Consequently, I propose, to draw up these conclusions as I indicated above and I hope that these modifications will be accepted.

1° *The concrete works constitute fairly often the most economical solution of many problems of construction of hydraulic works. The use of reinforced concrete for many works of this kind is pretty frequently a cheaper alternative, and likely to give suitable guarantees.*

2° *The works of Portland cement concrete, reinforced or not, must be carried out with a concrete so compact, that it can be guaranteed against desagregation, either at the sea or elsewhere. The use of blocks of non reinforced concrete, or gun-cement on the facings appears recommendable in view of increasing their watertightness.*

3° *The planning of re-inforced concrete works, exposed to the action of the sea, requires special study; they should have wider dimensions, and have stronger and more simple forms than similar works to be established elsewhere; there is occasion to fix generally large minima for the thicknesses of concrete and especially for recovering reinforcements.*

4° *The use of puzzolanic additions or of special cements such as slack cement (ciment fondu) must be carefully used.*

5° *It is desirable to proceed with research work on the durability of Portland cement at the sea, during long periods.*

The preservation of concrete re-inforced or not will have to be made the object of profound studies in view of future international Congresses.

The Chairman. — For the benefit of those gentlemen who were not able to follow M. Voisin I will read the six Conclusions as he suggests.

Before asking anyone else to speak, I will ask Mr. Humphreys if he has any comments or criticisms to make on M. Voisin's remark.

Mr. C. W. Humphreys. — The only point that arises on Conclusion n. 1 is the addition of the word « frequently » and the word « often ». As M. Voisin said, it does not make the conclusion quite as absolute as I put it. That it is a precautionary step which I myself would be quite prepared to accept.

My second Conclusion is drawn in rather more general terms than M. Voisin's which says that Portland cement structures should be constructed in a very dense concrete with a very small percentage of voids. I deal with that by saying that is should be constructed under competent supervision in concrete of such density and impermeability as to secure entire, or reasonable, immunity from harm. Then M. Voisin goes on to add that the use of cement-gun is advisable. I see no harm in that addition.

The third Conclusion is really the same as mine expressed in other words, except in one respect, that I use the word « simpler ». « *such design to be of more ample dimensions and simpler in form than for similar structures elsewhere.* »

The Chairman. — I think the difference there is that you suggest that a minimum thickness should be adopted generally. M. Voisin says : « *large minima should generally be adopted.* »

Mr. C. W. Humphreys. — I hold that you cannot have too simple a shape for any work that is best the very first day that it is put in.

In the fourth Conclusion M. Voisin suggests the addition of the

words « *or the use of special cements* ». That is quite a good addition

Conclusions 5 and 6 are practically the same as mine with a slightly different wording.

M. Coen Cagli (in French). — I think it would be better to read the conclusions over again one by one and submit them for discussion. In a general manner however I agree with my eminent colleague M. Voisin, who has explained his conclusions so clearly and so exactly. I have however a few remarks to make.

At the end of the first point, M. Voisin proposes to say that reinforced concrete would be a cheaper solution, and likely to offer suitable guarantees. It seems to me that the word *suitable* (convenable) is a little too strong, especially after what M Voisin himself has just said.

The word « *sufficient* » is to be preferred in my opinion.

M. Voisin. — I accept the word « *sufficient* ».

M. Coen Cagli. — I should like to know why you say « use of cement in sea-water or elsewhere. »

M. Voisin. — It is the formula employed by Mr. Humphreys in this conclusions.

The Chairman. — May I just interrupt to say that this Report is a communication which is made to the Congress? It is not proposed to ask the Congress to adopt it or vote upon this communication. We need not argue particularly about « reliable » or « adequate » or about, « recommending » or « thinking it is desirable ». We have not to vote upon it. It is a communication which is made to the Congress for the information of the Members of the Congress.

M. Coen Cagli (in French). — At paragraph 4 : « the practice of adding pouzzolanic matter to the mixture or aggregate must be studied extensively » it seems to me that apart from the undeniable necessity of studying systematically and most thoroughly this

question it would now be advisable to recommend the additions of which it is question.

M. Voisin himself has said that pouzzolanic matter is largely used in Italy. In fact in Italy we use as much as possible for sea works only fat lime mortar and pouzzolana, which have always given under all circumstances absolutely perfect results as the remains of the millenary works demonstrate. We do not generally resort to the use of cement in Italy except in case of necessity, and then we have only used it for some little time for sea works by adding to the mixture a certain quantity of pouzzolana which we found in many circumstances to be absolutely efficacious. It is true this practice has not existed long enough in our country for us to be able to draw definite indications from it, but it must not be forgotten that this practice has been known a long time in other countries such as Belgium and Holland, where it is a common custom to add a certain proportion of trass to the mortar with the object of assuring the neutralisation of any free lime.

I have nothing to say on point 5.

As to the last point, I should like to say the question of the use of reinforced concrete can remain on the order of business not only for the next Congress, but also the following Congresses.

M. Voisin (in French).— I agree with the last resolution. Nothing prevents us from studying the question at the next Congress. For point 4, it seems to me that the sentence should be divided into two parts. I have not contemplated the use of pouzzolanic additions. I have made the study of cements. One could not be more affirmative. I wished to put the two sentences together, but I have changed my mind as you have seen. If we desired to make the separation, we could say that for the pouzzolanic matter met with under certain forms, the assistance of the french engineers could be obtained.

The Chairman. — I propose, in order to have this on the records of the Congress, that in addition to this Report of Mr. Humphreys and the Conclusions which he has reported, these variations in his conclusions should be recorded in the minutes of the Congress, so

that they will be available for the guidance of whoever prepares the Agenda for the next Congress.

It will stand as a permanent record that these opinions have been expressed with regard to these Conclusions. Is it your pleasure that that should be done ?

(Agreed to.)

* * *

Communication n° 2. — **Use of liquid fuel for navigation and its consequences.**

This communication has been dealt with by Messrs. Prado (Chile); Boris and Bricard (France); Hyne and Kermode (Great-Britain); Baulino (Italy); Popesco (Roumania); Seth (Sweden) and Holmes (U. S. A.).

M. Bricard (in French). — The advantage of an internal combustion motor that it is always ready to start has often been remarked while to attain the same result with a steam plant, it is necessary to keep the boiler under pressure, which entails expense for fuel. In the case of tugs of which the service is intermittent this superiority of the Diesel motor is extremely important as the following example shows.

Navigation on the Seine between Paris and Rouen is done by day with numerous stops necessitated by the lockings of convoys which comprise as many as nine barges. In winter the duration of the daily towing falls to 10 hours. The National Office of Navigation has constructed a certain number of tugs for this service provided with Diesel motors of about 350 HP. of different makes.

The comparison was made between these boats and steam tugs of 500 HP. The voyage between Rouen and Paris lasts from 1 1/2 to 7 days according to the season. The convoys only sail during the day. The duration of voyage is the same for each type of tug.

The steam tugs consume about 35 tons of coal to tow 9 barges. The gazoline tugs only consume 3,5 tons of fuel to tow six.

The consumption of weight per barge is then about 7 times less with gazoline than with coal.

The rotation is a little accelerated from the fact that the loading of gazoline is faster than that of coal. However the necessity of examining frequently the Diesel motors makes the two types about equal from this particular point of view.

Proper working is ensured, and the tugs could certainly be employed in a dock service if the auxiliary gazoline compressor was re-inforced, which could eventually fill the starting reservoirs when they are exhausted by too frequent manœuvring. In another order of ideas, I should like to attract your attention on the second conclusion.

Among the products which could replace gazoline, may be classed vegetable oils. Experience has shown us that the Diesel motors work perfectly with this fuel.

On the other hand the cultivation of the immense tracts of land in Africa which are particulary fertile in oleaginous grain will create a source of power which is nearly be inexhaustible. This will be through the medium of vegetable life the utilization of radiated by the sun.

M. Boris. — Perhaps some of the Delegates would find it useful if I gave a short resume of the facts brought before the Congress by my able colleague M. Bricard, and after I have given that resume I will add a few words of my own on the same subject. One of the most important points made by M Bricard is the economy in fuel which has been obtained on certain tug boats on the Seine. These tug boats have to tow barges up to the number of nine. The work is entirely day work as the locks are not worked at night, there being no light installations on the Seine. The coal-burning tugs have been using 35 tons for their towage work while the oil-fuel tugs have only been using 3.5 tons, i. e. one to ten. The number of barges towed, however was not the same, nine barges being towed in the first case against six in the second case

The Chairman. — Are these Diesel engines ?

M. Boris. — Yes. Nevertheless, the economy is one to seven. Seven times more coal than oil fuel has to be used. That fact

is accounted for by the boilers being in action during the whole of the night and also by the number of locks which have to be gone through. That is the first point.

The second point is that the manœuvring of the tugs has been perfectly satisfactory, and it may be taken as granted that such tugs can be used without any trouble for work in docks. The only necessary precaution to adopt in such tugs for dock work is to have air compressors slightly more powerful in order to enable the tugs to refill their air reservoirs after a certain amount of manœuvring.

With regard to Sir John Cadman's General Conclusions, M. Bricard has drawn the attention of the Congress to the possibility of using vegetable oils which can be obtained in large quantities from Africa mainly, and which are practically an inexhaustible guarantee against the shortage of oil fuel.

I should like to add a few words of my own to the discussion for the General Report in order to draw the attention of the Congress to one point which happens to come under the previous communication (N° I) as well as under the present one, and makes them indeed closely interlocked, namely the storage of oil fuel in concrete tanks.

Now, the paper prepared by Mr. Bricard and myself refers to such storage existing in the United States up to 800 million gallons, this figure being quoted from a book entitled « Fuel Oil in Industry » by Stephen D. Andros, former assistant Professor of Mining and Research at the University of Illinois, published in Chicago in 1920, which gives information at some length about the various concrete oil reservoirs in use in the United States. We have not been able to check the information, but we believe it is perfectly reliable. The list given of main concrete reservoirs existing includes several very big ones, some of which are above the ground. Two have an inside diameter of 110 feet and a depth of 33 feet. Probably they are the first concrete tanks of such a size and kind to be built above the ground, and they have withstood hurricane and flood without sustaining any damage.

We thought it might be well for the Association to bear this matter in mind when considering the program of any future Con-

gress and I would therefore suggest that this Section should adopt the following Resolution :

« *That careful studies concerning the accommodation for the reception and storage of liquid fuel be invited for consideration at the future Meeting of the International Navigation Congress.* »

I would like, in conclusion, to pay my tribute to the work of the very able and prominent Engineers who have contributed Papers on this subject.

The Chairman. — I am now beginning to understand, after listening to the last speaker's remarks, why subjects of reinforced concrete and the use of liquid fuel were taken together. I had no idea when we began to consider these two questions that they were so intimately connected as they apparently are.

We do not adopt the recommendations in the General Report, but I think I might put it to you that we should adopt the Resolution which M. Boris has proposed, namely :

« *The second Section proposes that careful studies concerning the accommodation for the reception and storage of liquid fuel be invited for consideration at the next Meeting of the International Navigation Congress* »

Is it your pleasure to agree to that Resolution ?

(Agreed to).

The Chairman. — That concludes the business for this afternoon, but before we rise I think it would be appropriate if we were to express our thanks to Mr. Humphreys and to Sir John Cadman for the trouble they have taken in giving us their summarised statements on the Papers which were submitted. I am sure you will wish to convey your thanks to those gentlemen for their interesting remarks.

The resolution of thanks was carried by acclamation.

Ajourned to morrow, Friday, at 10,30 a. m.

SECOND SECTION

(Ocean Navigation)

SEVENTH MEETING

Friday, July 6th. 1923 (morning)

Sir Ernest GLOVER, Bart., in the Chair

The meeting was called to order at 10.30 a. m.

Communication n° 3. — **Utilisation of tides for the production of power for the working and lighting of ports and for maritime works (working of lock gates, etc.).**

This Communication has been dealt with by Messrs. Yankez (Chile); de Rouville (France); Latham (Great Britain); Cattaneo (Italy); Harmsen (Holland).

The Chairman. — I call upon Sir Maurice Fitzmaurice to make an announcement.

Sir Maurice Fitzmaurice, Vice Chairman. — You are about to open a discussion this morning on the subject of « Utilisation of tides for the production of power for the working and lighting of ports and for maritime works. » The General Reporter on this subject is Mr. Charles S. Meik. It is with great regret that I have to announce to you that Mr. Meik died yesterday. He had undertaken the work of general reporter when he was ill ; in fact he was much more ill than any of us thought. In spite of that he carried out his work, and wrote his report when he has on a bed of sickness and suffering very much. I am sure the members of

the section will join with me in expressing our great regret at his death. I might say that to me personally it is the end of a friendship of 40 years. I got my first training as an engineer under his brother the late Mr. Walter Meik. The two brothers held a foremost position among the dock and harbour engineers of Great Britain.

The work of the Congress must, however, go on, and Mr. Meik's partner, Mr. Halcrow, has attended here to present the General Report by Mr. Meik.

The Chairman, — I am sure you all wish to show your sympathy and your appreciation of Mr. Meik's loss by standing in your places for a moment.

(The delegates stood in their places).

The Chairman. — Before asking Mr. Halcrow to give us his statement, I will call upon Mr. van Vloten to read a short statement.

M. van Braam van Vloten. — Mr. Chairman, allow me to draw your attention to the fact that we meet here today under the hospitable roof of the Institution of Civil Engineers where 30 years ago the International Maritime Congress of 1893 took place.

I should like to remind you that the one of the most important memoirs presented to that earlier Congress was by Mr. Blondel on flashlights and the physiological perception of instantaneous flashes, in which he clearly pointed out the fundamental fact on which flashlight apparatus are built.

The adoption of the « Feux-éclair » system, now everywhere in use in important modern lighthouses, has been the greatest improvement in coast lighting since the invention of lighthouse lenses.

Notwithstanding his physical weakness, the genius of this famous scientist has several times since given us a lead in our work and now he is the only survivor of that remote time who has today submitted a new report on the recent developments of coast lighting and signalling.

I thought it my duty to remind the present Congress of that

fact, as M. Blondel unfortunately cannot be with us today, and I hope it will be given to M. Blondel for a long time yet to contribute to the advance of physical science for the benefit of navigation all over the world.

Allow me to ask if this assembly would be disposed to associate themselves with me in this mark of gratitude (*Applause.*)

The Chairman. — Gentlemen, I take it from your applause that you all associate yourselves with Mr. van Braam van Vloten in desiring to convey to M. Blondel our regrets that he would not be with us today, and our hopes that he may long live to devote himself to the science in which he is so greatly interested. (*Applause*).

I will now ask Mr. Halcrow to present the General Report on « The Utilisation of tides for the production of power for the working and lighting of ports and other maritime works (working of lock-gates, etc.) »

Mr. Halcrow. — The General Reporter Mr. Meik, after studying the reports presented on the utilization of tides for the production of power has come to the following conclusions :

It should be noted that according to the terms of the communication the tide should be utilized for the power necessary for the working or operation of a port and that consequently the height of charge called upon to generate the power depends on the range of the tide in this port, no margin is then admitted in the choice of a favourable emplacement for the production of power contrary to what certain reporters could be led to believe.

The range of the tide in our country varys from 6 feet at Yarmouth, to 40 feet at Avonmouth but we must not lose to view that these figures represent the available height of charge during short periods and only at low tide.

The average head of charge would be very inferior to these figures, dependent on the length of time during which the turbines are maintained in operation.

If the water used at the locking of the ships for the entrance and exit of the docks is employed for the production of power, this production becomes complicated and costly. If on the other hand, we wish to make use of the height of charge of the water

in the dock to the exclusion of the water used for locking, it seems quite possible to realize a disposition with a view of the utilization of the tide for the production of power but the necessary expense would be considerable in most of the ports of our country, considering the small height of charge available for the turbines. In all cases, it will be necessary to provide for the storage of the water, either at a higher level, or of the electric current, if we wish to resort to the latter for the transmission of power.

None of the reporters has presented any figures as finally depends to the cost on which the practicable possibilities of realizing this scheme, but the reports numbers 70 and 72, express some opinions on the cost. It must not be forgotten that today all the great ports dispose of cheap electric current and that in nine cases out of ten it will be more economical to buy current than to utilize the water of a dock in which the large ships require a great depth of water.

Mr. M. W. Harmsen (N° 72) is the only reporter who supplies information about the production of power by means of the height of the fall available at the place where it must be utilized, and he gives details and plans of a plant under construction at Hansweert, on the Zuid Beveland canal in Holland. Mr. Harmsen points out that even in this case the cost will be heavy, and that the result will not give the solution of the problem contemplated. The results of this enterprise now being carried on under the direction of Mr Harmsen will be extremely valuable and will supply many indications.

It appears that the problem depends chiefly on the possibility of storing water at high level for the production of power at periods during which it is not possible to utilize the tide for this purpose, the latter being at its maximum level or nearly so.

This being the case it does not seem possible to formulate any kind of rule relating to the economic power by means of the tide in ports; the case of each port must be examined while taking into consideration the circumstances which it presents.

M. Cattaneo (in French). — Mr. President, Gentlemen : I make my excuses for speaking French, not knowing English sufficiently to be able to speak correctly before this honourable assembly.

I also make my excuses if in my report, I have dealt with waves, the phenomenon of tides not occuring on the Italian coast.

I am convinced that the waves are more easily utilizable than the tides from the practicable and economic point of view. They object that England, which possesses numerous coal mines, can hardly be interested in the utilization of waves and tides, as power. I answer that if England made use of this natural power, she could export the coal thus economised with great profit.

Many persons smile at my affirmations; but I am certain however that in a few years we shall see astonishing results from the utilisation of waves and tides.

The Italian State Railways have entrusted to me their 300 HP experimental station at Genoa.

I express the suggestion that the governments of maritime countries encourage the development of this new source of power, by giving a premium per marine HP installed, and by granting concesions of beaches and portions of the shore at favourable prices.

This encouragement would not involve the States in excessive expenditure.

M. de Rouville (in French). — Gentlemen.

I have not the intention of returning to the main point of this question.

It has been sufficiently developped by the reporters and again, just now by M. Cattaneo.

I remember that this problem was presented in addition during the work of the 1st Section. But it was put aside and sent back to the 2nd Section.

We only wish to point out that the General Reporter has not given a general opinion.

However the special form under which this problem was submitted limited to the case of ports, has evidently contributed to this negative result.

Most of the reporters agree in thinking that the use of tidal power in the ports themselves does not present much importance. Even taken generally, this problem is too new to enable a definite resolution being passed on it. From the point of view of its fu-

ture, it is probable that the subsequent Congress will find a firmer and more secure base of discussion for the said problem.

Meanwhile I should like to pass a resolution, if the Section wishes to agree to it, which could be thus formulated : « The engineers attached to the study of the utilization of tides, should keep in touch with one another so as to mutually take advantage of the ideas presented by each of them. They could thus benefit from the experiments and trials certain States have begun to encourage ».

M. du Croix. — The question which has been dealt with by M. de Rouville is not one which belongs to this Congress. It is not a navigation question. It may be very interesting, but it has nothing to do with navigation.

The Chairman. — I will ask Mr. Halcrow to ceply to the point that was raised by M. de Rouville as to his regrets that Mr. Meik did not provide a definite suggestion of his own as to what could be done.

Mr. Halcrow. — The question which M. de Rouville raised, as regards the general lines on which Mr. Meik concluded his report, was discussed by Mr. Meik several times, and he found it very difficult to lay down any general lines, as the question is really a local one. When one considers the great variation in the rise and fall of tides at various ports throughout the world, it will be realised that no general rules can be laid down.

I made one or two notes when I found that I should have to represent Mr. Meik here, and the points which I think deal with the whole question are these : the period during which power can be obtained from the tide will rarely correspond with the period of demand. It is therefore necessary to store the energy produced, for use when required. The solution of storing the energy produced by the tide will probably be found by pumping water to elevated reservoirs, from which it can be drawn off as required for driving turbines. As the cost of elevated storage, where no rising ground is available, will probably be prohibitive, the chances of harnessing economically the power of the tide at such ports are very small indeed. That is to say, in the case of ports which are

on flat land near the coast, as many of them are, there is really very little hope of harnessing the tide for generating electricity for lighting and power for working lock-gates, cranes, and so on, on a commercial basis. You can get power from the tide certainly, but it will not give you the power when you want it. Therefore you must take it when you can get it, store it, and use it when you require it. Mr. Meik concluded (and I must say that I agree with him) that each port must look into the matter for itself and see what can be done. There are no general lines which can be laid down.

M. Cattaneo (in French). — It was observed that the installation of plant for utilizing tidal power would be very costly. I take the liberty to draw your attention to my combined tidal basins, utilizing the action of the waves and tides, whence a great reduction in the dimensions of the basins and expense of installing plant. My ondo-pumps can also utilize the waves of the Ocean, and their installation is less expensive than that of tidal basins.

In conclusion, if important trials are not taken, we can never succeed in having conclusive results, and for this, we must have the assistance of the governments. For never has a more formidable problem come before us, and to solve this problem, we must look farther ahead, without seeking immediate profits, and be ready to sacrifice money and labour in order to attain the final success. Let us recall the commencement of the steam-engine, steam navigation, hydraulic works, electricity, aeronautics, etc., etc....

The Chairman. — Our thanks are due to Mr. Halcrow for, at the last moment, leading this discussion. We appreciate the difficulty he must have had in suddenly taking up the matter. I think we all agree that this matter is in its infancy, and the question seems to be : who is going to try the experiment and incur the cost of the experiment ? The one practical suggestion which arises out of to-day's discussion is the desirability of the engineers who have this problem before them in the different countries getting into communication with each other, exchanging their views, and inducing some port or harbour authority to try the experi-

ment and see how far they can get with it. I think you will all joint with me in thanking the gentlemen who have presented the papers, and Mr. Halcrow for his contribution to the discussion. (*Applause.*)

* * *

The Chairman. — We will now proceed to *Communication n° 4* : « **Principal advances made recently in lighting, beaconing and » signalling of coasts. Standardisation (unification) of the » languages of maritime signals.** »

This communication has been dealt with by Messrs Urbain (Belgium); Blondel and de Rouville (France); Hood, Butterfield, Curtis and Steel, Stevenson, Browne (Great Britain); Luria (Italy); Ishikawa (Japan); van Braam van Vloten (Holland); Schokalsky (Russia); Serret y Mirete (Spain); Lundenberg (Sweden); Rutnam (U. S. A.).

Mr. Hood. — Before entering upon my report, I should like to mention how deeply and sincerely I appreciate the honour done to me by this Congress in asking me to report on papers submitted to it for discussion. These papers, for the most part prepared by engineers of eminence, have been to me a peculiarly interesting study, and the task of summarising them has been a labour not only of very great pleasure but one of much instruction. I understand the papers and the report are to be taken as read, but I wish to make a special reference to one of the papers, namely, that submitted by M. Schokalsky of Russia, which is a record of a double failure, possibly from inability, to maintain a structure on a exposed rock. There are not many of us who have the courage to come forward and describe our failures.

(Mr. Hood then proceeded to summarise his report.)

Captain C. L. Hussey. — Under this discussion, perhaps this Congress will consider the international adoption of some system of under-water signals by which vessels in an area of reduced visibility may give out information relative to their course, and may in return receive information as to the courses of other vessels in the vicinity, and as well obtain bearings of such vessels. Such a system will obviously be of inestimable advantage to shipping, particularly in congested coastwise areas, and will greatly reduce the hazard of collision.

The development of under-water sound signalling apparatus has reached such a stage that we feel justified in proposing that steps be initiated to incorporate in the International Rules of the Road a system of sound signalling that would make this means of communication available for preventing collision during fog or reduced visibility.

The radio compass and position finders now enable ships to approach the coast in thick weather with all the attending advantages, notably the economic advantages. It remains to supplement this aid to navigation by any means that may be provided to ensure the safety of vessels coasting and entering port, in the event that the further advantages gained are commensurate with the cost of such installations.

Various means for transmitting and receiving under-water sound signals are now available, and while but comparatively few vessels have been fitted with transmitting apparatus, several thousand are fitted with receiving devices. It is thought that were rules for the use of such apparatus inaugurated to avoid collision and incorporated in the Rules of the Road, the advantages of the system would be so apparent as to greatly accelerate its introduction into general use, even if such installations were not made mandatory by law.

At present there is no means by which a ship proceeding in a fog can readily indicate her course to other ships in the vicinity. If there were an International Code adopted for the purpose, a ship fully equipped with submarine sound signalling apparatus could send out periodically her course, and at the same time determine the course and bearing of a vessel similarly equipped. Ships only partially equipped, that is, with only the sending or receiving devices, could still be benefited to the limit of capacity of their installations.

In presenting this matter for the consideration of the Congress, personal experience in command of a naval vessel on patrol duty for many weeks off Nantucket, has convinced me of the utility of the under-water submarine signalling apparatus. Also, experience covering a considerable number of years in various other vessels has led me to believe that the installation is readily made at relatively small cost, considering the advantages accruing, and with little attention and cost for upkeep.

In view of the obvious advantages, if not necessity, for such means of communication, the following resolution is proposed :

« *It is the sense of the International Congress of Navigation that safety and economy renders it advisable to instal under-water sound signalling apparatus in vessels for communicating their course and speed, and at the same time indicating their bearing to other vessels which, under prevailing conditions of restricted visibility, may be regarded as in the area of dangerous proximity : also that the Morse Code, or other similar code, be adopted to facilitate communication by such under-water sound signalling apparatus.* »

The submarine signalling apparatus, which we have been using in the United States Navy for a great number of years, has been a source of the greatest assistance to us when we had to make port on time, and it seems to me that the same thing would be found greatly to the advantage of other nations not only for safety but economy in the operation of merchant vessels.

The Chairman. — I must explain to Captain Hussey that to propose a resolution on one of the Communications is not in accordance with the principles of the Congress. We adopt resolutions on the questions which have been submitted. I think the most we can do, so far as this is concerned, is to agree to a recommendation that this should form one of the questions to be considered at the next Congress. This will give an opportunity for papers being written on the specific question as to whether submarine signalling apparatus should be adopted by all ships, before the Congress commits itself to saying that that should be the case. I hope Capt. Hussey will understand the position.

Captain Sir Acton Blake. — I should like in the first place to associate myself with everything that has been said by Mr. Hood, and, as one of the people responsible for the lighting of the coasts of this Kingdom, I should also like to add my word of appreciation to those people who have written papers on this subject. They are to immense value to everybody who has anything at all to do with the lighting of coasts. I agree with Mr. Hood that it is impossible in the short time at our disposal to discuss all these

questions, but I am certain that the mere reading of the papers will be of value to everybody who has to deal with lighting.

There is one point to which I should like to make some reference. I have been very closely connected quite lately with the question of buoyage. M. Blondel and M. de Rouville in their papers raise the question of the colour of buoys. I do not think we can get very far ahead with regard to any international conference on a universal system of buoyage. We started in 1862, and again in 1865, and the Washington Congress in 1895 took up very nearly the same position as the authorities here then adopted, except on the question of colour. The question of colour will always be a difficulty. The conditions in every country, certainly countries such as our own, are so difficult from a geographical point of view that an immense latitude will have to be left to the local authorities to carry out their work, agreement being reached only on the main principles. That, I think, to a very large extent has been done as far as shape, and so on, is concerned, which is more important no doubt than colour.

Why I rather elaborate the question of colour is because, owing to the incidence of the great war and the multiplication of wrecks all round our coasts, the question of marking wrecks came very close to us. It was impossible to put wreck-marking vessels to mark all these wrecks, and we had to begin to use, for the first time, lighted buoys. At the instance of the Board of Trade, Trinity House called a conference of all the authorities in the United Kingdom, and it has just agreed, and issued to-day I think, its finding of what it considers is right for the marking of wrecks. It is intented to eliminate altogether green from navigation lights, except for the starboard light of the ship, and wrecks, so that any man who sees anything green will know it is either a vessel under way, or else, he can read and run, or keep away from green as being a danger. This finding will be published and sent to all the lighthouse authorities today. It has altered entirely the system of marking wrecks.

I am certain that any agreement that can be come to can only be in general terms. No legislation has ever been evolved from any conference on the subject of a uniform system of buoyage. Each country has adopted as largely as possible what the various

conferences have laid down, and then they have had to make their changes on purpose to meet local conditions, partly on the score of expense, partly on the score of the geographical position.

Round our coasts we have tides run in almost every direction, and we have tried in this particular report on wreck marking to lay down a rule which we at any rate intend to use for some time to come.

The Chairman. — We are much indebted to Sir Acton Blake for coming here this morning. Might we ask Sir Acton whether copies of the report to which he has just referred would be available for members of this Congress ?

Sir Acton Blake. — I think I could promise that copies could be sent to the Secretary of the Congress, who could distribute them to the members. All the various lighthouse authorities will get them probably in the ordinary course of events.

Mr. Hägg. — With regard to the question of uniformity of colour and shape for beacons and buoys, I beg to draw attention to the Conclusion made at Washington, based upon the report of the Committee appointed to consider the subject. It is in this report mentioned that in the Baltic, with is very complicated channels in the enormous archipelago, a more elaborate system is necessary. I am not prepared to go into the question in detail, but I would like to mention that although we in Sweden naturally are most anxious to facilitate international navigation by suitable regulations as to colour and shape for beacons and buoys there are so very many complicated considerations to be taken with regard to the innumerable navigable waterways crossing each other, that I am afraid it will be difficult to find means of obtaining international uniformity without causing very serious disadvantages to the local shipping.

Mr. C. R. Putnam. — In the first place I should like to express my appreciation of the work of the General Reporter in the very interesting summary he has given of the many valuable papers pre-

sented on lighthouse matters. Eleven years ago at Philadelphia I had the honour of being the General Reporter on the lighthouse subject, and I know it is something of a task and Mr. Hood has had more than twice the number of papers to review that I had.

As for lighthouse work in the United States, it has been briefly covered in the report which has been presented.

I would like to refer to the more extended use of radio. I believe there are still very great possibilities for advance in the use of radio in safeguarding navigation, and that, in fact, we are only on the threshold of what may be done with radio, particularly in protecting ships in fog. In the United States our faith in this matter has been shown by our having already in operation seven radio fog signals, and the Navy in the United States is now maintaining a large number of radio compass stations on shore. I think the best system must be developed by experiment and test in actual service. The large number of papers which have been presented here, and the interesting character of them, and the large number of representatives of lighthouse services who are here, call attention to the international character of lighthouse work. There are few branches of engineering that are more admittedly international in character than the operations of the lighthouse services, because every important light is maintained not only for the benefit of the shipping of the country which built it, but for the benefit of the shipping of all the world.

There are many features of international importance, such as the question of more uniform systems of lighting around all the coasts, and the desirability of more progress in lighting some of the less advanced coasts, and this leads me to make the suggestion that in future congresses somewhat more opportunity should be given for careful consideration of lighthouse problems. I think it is necessary to have more than one meeting to consider this subject in order to give full opportunity for comparing experience and results in lighthouse engineering. The various nations have large organisations and are expending large sums of money in maintaining the lighthouse systems of the world, and many important technical problems are involved in this work which it would be very well to compare between different countries. I therefore venture to suggest that something may be put

in the minutes of this Congress, to be considered by a future organisation Committee, to the effect that some more definite plan be devised on another occasion for the full discussion of lighthouse matters. For instance, there might be a third section definitely devoted to the purpose of considering lighthouse problems. (*Applause.*)

In the United States, owing to the great extent of our country, we have found by actual experience that this idea is very valuable. We have from time to time conferences of our officers charged with lighthouse work in different parts of the United States, and we have found these conferences are valuable in comparing matters of engineering and administration in the different parts of our lighthouse service.

Captain Harold Browne. — A case which occured only last week shows the urgent necessity of improving our present methods of assisting vessels to navigate with safety during fogs. The cross-channel passage between Dover and Calais is a very short one, and the Captains are experts on that particular route, and yet last week one of those steamers was stranded under the Dover cliffs through an error in navigation. The fact is that although when the weather is clear one can get about with considerable ease, owing to the admirable way in which buoys and light-vessels are distributed, in a fog one is still almost as helpless as one was many years ago.

The stimulus of the great war and the needs of the different Navies involved, caused great advances to be made in what is possible in the way of assisting vessels to navigate during fogs. Three systems stand out particularly. One is the system of wireless direction finding, which is available at quite long distances, but which is unfortunately not quite so accurate as might be wished and which is liable to occasional unexplained errors. Then there is the system of radio acoustic sound ranging, which is available at medium distances — by which I mean distances up to about 50 and 60 nautical miles, and which is available under any conditions of wind, weather, and so on, and which has a very high degree of accuracy indeed. Then there is the leader cable system, which is useful when a ship is right in the channel leading up to the harbour itself.

There are those three systems — a long distance system, a medium distance system, and the close in shore system : radio-direction finding, radio acoustic sound ranging, and the leader cable in the channel itself. My own impression is that the system available at medium distances is the most important, because it is when the ship is within 20 or 30 miles, say, of her port that she requires most urgently to know her position with great accuracy. If she can be certain that when she arrives within a 40 or 50 miles circle of her port she will get her position with extreme accuracy, it does not matter so much to her what happens before she enters that circle. On the other hand, when she has made the approach to the harbour and sighted the first light vessel, she can feel her way from buoy to buoy up channel with safety. It is in the intermediate zone, when she is uncertain of her position (except that she knows the port is close to her, with its dangers as well as its safety) that her position is of the greatest importance. For that reason, although all three systems are most desirable and most useful, if you have to adopt one of them the medium system is the one which should have most attention paid to it, at any rate for the present.

M. Montarroyos (in French). — Mr. President, Gentlemen,

I do not propose now to deal thoroughly with the question concerning the principal progress realized in lighting, beaconing or signalling of coasts. Mr. Hood in his interesting General Report on this subject all the enlightenment necessary and each of us has found, in the different special reports, very precise information showing the present state of this question under all its aspects. The reporters have indicated the improvements which are included in the various methods of signalling. I have thereupon nothing more to say at present.

I should merely like to deal with a point on which I do not say it is necessary to draw your attention, for that is already done but which seems to me to deserve additional reflection. It is the necessity of unifying the methods of maritime signalling. All the reports of which I have just spoken agree in recognizing the necessity of attaining this object. And I take the liberty of pointing out to you a circumstance particularly significant tending

to confirm this necessity. Note that one of the results of the progress realized in signalling methods used today consist exactly of impressing still more their need of unification. For instance the report of Mr. Putnam who mentions the international aspect of the problems of coast signalling. M. Urbain, in his report, demands a new standard of signalling. M. M. Blondel and de Rouville state it desirable it is to get an international regulation in this matter. This regulation is so much the more urgent that the radiographic method of determination of the position is called upon to become soon one of the most auxiliaries of navigation; and we can only realize the uniformisation of the processes relating to this method by an international entente. Moreover in his conclusions, our General Reporter, without making any comments, points out all the same that the ideal in this sphere has not been attained, which we understand is a desire in favour of further endeavours which are necessary to attain this object.

Besides, we know how all the sailors, of the various countries, desire that this question be solved by the adoption of a common uniform, universal system. Now to obtain this solution, the problem must be considered under two aspects. One concerns the technical choice of the method or methods which must predominate; the other the way which must be followed so as in common agreement to succeed in fixing this choice : the way is no other than that of an international entente.

It does not behove me just now to suggest anything whatever about the subject of the technical method likely to ensure standardisation. I must just make a suggestion concerning the second aspect of the problem, that is to say the easiest way of obtaining the indispensable international entente, an entente of which the establishment seems to be the first step to make. Also I should like to draw the attention of Congress on the efficacious action which the League of Nations can exercise in this respect, by its consultative and technical organ of communications and transit, organ represented by a permanent commission of technicians appointed by the government of the various powers sitting there.

The composition and the methods of procedure of this commission which has given proofs of its capacity, permits it, in fact to

study the problem from all points of view and bring to it the solution desired. Moreover it is in constant touch with all the governments. That is I think sufficient to show desirable it is in the general interest, owing to the real advantages that would result, that the Congress accept, to this effect, the intervention of the League of Nations. It is in any case the organism which is naturally indicated; it could hasten the solution of this question so important and of universal interest.

Mr. Butterfield. — I should like to support the suggestion which has been made by Mr. Putnam, that in the future more time should be given for the discussion of this particular Section of of navigation, which is of such very great and vital importance. There are so many questions raised in this particular section that it is almost futile to attempt to go into any detail with regard to any one of them. For this reason I support the remarks of Mr. Putnam.

In pasing, one might take the question of wireless direction finding. There is not the slightest doubt that we are on the threshold of important developments with regard to this particular aid to navigation. The interchange of opinions of those whose duty it is to develop this in the interests of their own particular country can only result in deciding which is the most valuable, suitable system or systems for adoption. That alone is a sufficient argument for this matter being further developed by this Association.

The question as to what is the proper length of flashes from lighthouses is also a very important one, as is also the question of wreck marking.

I was intensely interested to hear Sir Acton Blake refer to the decision of Trinity House that in future green lights should be reserved for the purpose of marking wrecks. I am somewhat interested in this question and I am delighted to hear that Trinity House, which has always given considerable attention to this particular subject, has come to what will undoubtedly be a most valuable decision on the matter.

The only other thing I would draw attention to is the combination of aerial and maritime lights. It does seem to me that, from

the pure ground of simplicity and economy, if you combine the two requirements and make the one light answer both purposes, you are rendering a great benefit to commerce in general and the navigation in particular.

I have nothing further to say, except that I think the particular question which is now before you is of sufficient importance that in the future more time should be devoted to it, and I would suggest that it be made a separate section. It is irrevocably tied up with the question of navigation, and I am sure not only masters, and owners, but probably those very charming people, the underwriters, are all vitally interested in it.

M. de Rouville (in French). — Mr. President, Gentlemen, I should at first like to say a few words on two of the declarations of the preceeding orators.

That of Captain Hussey is very interesting, but it appears to be outside the sphere of our studies. We deal with signalling to ships the dangers of the coast and not those arising from ships themselves or from other obstacles. No doubt the progress accomplished in the mutual signalling of ships can benefit from shore signalling, but they are in principle two distinct problems.

In his statement, Sir Acton Blake sees great drawbacks of all kinds, especially of a financial order in altering the regulations existing in England.

We think we ought to repeat however, that the interest which unification of signals presents is great enough for us to ignore the undeniable difficulties of this eventual operation.

What would the y say, if on the railways for instance each station master was allowed to dispose as he thought fit of the signals providing for the normal working or incidents of working of railways ? Not only have the various national systems unified their rules on their own lines and in all their extent, but many of the different countries have come to an agreement on this subject. And however the railway mechanics work but seldom outside of their company's lines or their country, whilst navigators must frequent different ports and foreign coasts.

We have felt so much the danger of variety in signals, that we

have done away with it, even the entrance and exit signals of our ports.

In agreement with our Swedish colleague, we do not ignore that a unique system could not be suitable to all coasts. But a limited number of parellel systems could be planned which would be inspired as much as possible by mutual direction, in ceasing to contredict one another on the essential points.

As to the expenditure that would be incurred, it would be of little importance considering our present enormous budgets and certainly would not increase them out of proportion to the interests at stake.

The transitory period can finally be organized with a precaution which is of nature to inspire navigation with confidence, as the transformation work carried out in other countries as already proved.

We are then of opinion that this question must not be lost to view, and we are happy to find that our colleague of Trinity House has admitted in the conclusions of his general report, to which we shall now come back, the advantage of adopting an international uniform system. We consider translation errors excepted, that the first points of the conclusions of the General Reporter are indicated as interesting technical subjects proposed only for examination by future congresses.

While then being of his opinion, that they could in general supply the next reports required on the matter with useful information, and in consequence without wishing to open at present a discussion which would be at least premature, we think we should state merely as an observation.

a) That the use of re-inforced concrete in lighthouses is especially what is needed, that it is convenient for shore establishments, where economy and prompt execution is sought after, that it would be difficult to apply it on a large scale in constructions pertaining to the sea; *b*) that the study of the suitable duration of flashes emitted by lighthouses, should be preceded by comparative experiments which would be carried out everywhere under similar conditions, that is to say with the same luminous projection per flash; *c*) That a uniform method of experimental determination of the instensity of the lighthouses would perhaps still

be more useful than an uniform method of calculation for this intensity, for theoretical formula seem especially interesting for the study of projects and their comparative value; they must moreover take into careful consideration notably the duration of the flashes; *d*) That maritime and aerial lights would benefit by being combined on the coast, so as to avoid any hesitation or risk of confusion by the various navigators.

On the other hand, the two last paragraphs of the conclusions would seem to give rise to immediate desiderata by the section :

A. — For No. 9 we think in fact that an international commission would be useful, in order to determine the best process for radiogoniometric improvement.

But, on the other hand, the choice of the length of wave depends especially on international conventions of W. T. (which are under revision, and have already given rise to exchange of views between certain nations) owing to its repercussion on other civil and military communications and, also that the use of radiogoniometry depends on the dispositions of naval armament and navigators still more perhaps than the services of signalization, we think that, while wishing for a meeting of a commission especially charged with the study of the question and demonstrating the data collected elsewhere for the length of waves, we could in any case benefit from the meeting of a commission dealing with more general problems relating, for instance, to the security of human life at sea, to attach thereto this particular point of radiogoniometry.

A resolution could be formulated which would tend to the formation of an international commission entrusted to search for and study the best system suitable for the exact enumeration of radiogoniometry, while taking into consideration the most favourable length of wave already indicated elsewhere (or considered with a great chance of international adoption) for such signals; in any case to the introduction of the question to the order of business of any commission which would have met in the meanwhile to deal with these questions of security at sea.

B. — For paragraph No. 10 (Unification of the languages of maritime signals) we propose one or other of the following forms:

If we were willing to take as basis the resolutions already

emitted at the former conference of St. Petersburg, where 16 nations were represented and that certain of them (Italy and Spain), have put into practicable use, we should confine ourselves, to confirming the desire that the resolutions of the International maritime conference at St. Petersburg (1912) with respect to the signalization by buoys and coast lighting be realized as soon as possible by all the nations.

In default of this expeditious solution we would confine ourselves to wishing:

« That a new international maritime conference be convoked « to continue the work of Petrograd, tending to the unification of « maritime signalling. »

We ask if our colleagues of the principal lighthouse services represented are willing to agree to one or other of these resolutions, especially our colleague of Trinity House, who had to indicate a desire of this nature in his General Report.

We associate ourselves finally to the suggestion of the representative of the « League of Nations » who will consider the possible co-operation of his section of Communications and Transit. This intervention appears to us one of the ways to succeed in this work so useful for the unification of maritime signalling.

Rear Admiral Reynolds. — Any activity, service, or agency which as primarily to do with the safety of ocean navigation would seem to be one which might properly be considered by a Congress of this nature. I would therefore offer this suggestion : « It is suggested that the deliberations of the Congress at its future meetings be broadened or extended to include agencies or activities in the several countries which have for their prime or principal object the saving of life and property from the perils of the sea, that is, the rescue of passengers and crews of vessels stranded or wrecked on the coasts or disabled at sea, and the salvage of the vessels and their cargoes. »

I believe that most maritime countries have what may be considered live-saving institutions, supported either by the Government or by private contributions. In the United States we have a more extented service, I think, which is entirely under Government control. It is the United States Coastguard. It maintains

a force of approximately 4,500 people. Of these 270 are commissioned officers, over 400 warrant officers, and the rest enlisted men. In so far as the enlisted men are concerned, they are about equally divided between the ships and the shore stations. We have some 273 shore stations at various points along our coasts, each station being manned by a warrant officer or a petty officer, and from six to ten enlisted men depending upon the locature of the particular station. A constant patrol is kept, and a constant look-out is maintained. Vessels approaching the coast in places of danger are warned off. Should one by any unfortunate mischance become stranded or wrecked, every effort is made, first to rescue the crew and passengers, and then to save the ship and its cargo. It maintains a number of vessels, some 26 of which are sea-going craft, capable of proceeding to sea on short notice, in any weather in response to an S. O. S. call. They go hundreds of miles off shore, and sometimes rescue a ship and all hands. All this service is performed under Government supervision, and without charge.

The Chairman. — May I interrupt ? You are getting rather away from the subject.

Rear Admiral Reynolds. — Very well. I will just make the suggestion, and leave it there.

Captain H. Clarke. The question of marking wrecks is a very important one, and I entirely agree with what Sir Acton Blake has said. It will be a good thing for all seamen to know that there will be in future only two green signals, one a starboard light and the other a wreck-mark.

I agree with what has been said, that this is much too big a question for us to fully discuss here in the short time at our disposal.

I consider that this morning's meeting is really the primary meeting of this Congress, for is not the question of safety at sea one of the most important matters of the day ? This morning we have had discussions with regard to lights, fog signals, wireless stations, direction finders and cables for leading ships into

harbours. I agree with the Swedish representative's remarks on the question of a uniform system of buoyage. I look upon the Baltic in the summer time as the Piccadilly or the Charing Cross of the sea. Vessels are coming and passing in all directions, amidst a large number of shoals. How are you going to have universal system of buoyage that would apply to the Baltic ? It would be impossible.

M. van Braam van Vloten (in French). — Mr. President and Gentlemen,

For my part I quite agree with Mr. de Rouville on his propositions.

I should merely like to ask in addition, if the meeting would not be willing to rally to the opinion of Messrs Putnam and Butterfield, that the time devoted at the present Congress to questions of an importance and character essentially international is too limited and that it would be desirable to give more time to them in future congresses, unless we are induced for this reason to constitute a special organism which would deal with these questions. This organism coud be more or less distinct from the navigation congresses, but it would not forget in any case the assistance that our International Association would have given to it to facilitate its constitution.

M. A. Luria (in French). — Mr. President, Gentlemen,

As delegate of the lighthouse service, I agree entirely with the conclusions proposed by M. de Rouville, chief engineer to the Central Service of Lighthouses and Beacons, in France.

In Italy they are going to erect the first lighthouse, the monumental lighthouse of Triest, with re-inforced cement having group lights of three flashes with a tower about 66 meters above the ground and provided with a geographical range of 26 miles.

We have obtained good results in Italy by adopting flashes 0 s. 35 as the minimum duration of flash.

I think it necessary to have practicable estimates made everywhere of the luminous power of maritime lights.

And the classification of the optic apparatus of the lighthouses

must be made not only on the base of the order « focal distance » but on the base of luminous power.

It is very important to install combined aerial and maritime lights on the coasts, so much the more as it is not very difficult to gradually transform the most important lights so that they present not only the actual rays to the horizon but horizon rays to zenith, for aerial navigation which has a great future.

In Italy we have found it a great advantage to use dissolved acetylene for all permanent lights and for luminous buoys. We have adopted in several cases for lights looked after by keepers, acetylene which is made on the spot by good generators.

I do not speak of fog signals for in Italy we have not much need of them. The few compressed air sirens which we possess on the coast of Venice work very well.

We have just installed at Cape Guardafui at Somili a turning radio-light and a directing radiogoniometre with a phare of which the flashes have a range of 26 miles. At the same time an acetylene signal light will be put into operation at Ras Hafun and a petrol signal light at Ras Alula.

As Mr. Hood has so well said in his General Report, the need of development of the illuminating power of maritime lights has not diminished at all. And since it is question of an *international service* of great importance for navigation, a service which has as its moto « Olim periculum nunc salis » « Lux nautis securitas». The nations should communicate with one another concerning the results of their most important studies and the innovations in this service.

I am completely in agreement on the necessity of constituting an international commission, entrusted with the research and study of the most suitable system of the radiographic determination of direction taking into consideration the international adoption of a uniform system of signals by buoys and by diurnal and luminous signals.

M. Marques Couto. — Mr. President, Gentlemen,

I should like to make a suggestion. The General Reporter said that it was very difficult to succeed in unifying a system of beacons. I express the wish that this conclusion be printed

and communicated to all the nations, so as to unify the problem for all those who take its importance into account, and the facilities which this unification would bring to navigation.

The Chairman. — We have had very interesting, if somewhat prolonged, discussion this morning. I think the conclusion of the whole matter is that Mr. Putnam's suggestion should be seriously taken into consideration for the next Congress. The questions of the lighting of coasts, of beacons, buoys, submarine signalling, and other methods of signalling to other vessels during a fog, and what the course of each vessel may be, are also interesting and bristling with difficulties and technical points that require consideration. This was only meant to be a communication of interest to this Congress, but it has produced a discussion this morning which proves that on another occasion very considerable time and opportunity should be given for threshing out these questions. Whether it is better to form a third section, or to put it in the form of a question and give it a whole day for discussion after papers are written on it, is a matter for the organisation committee of the next congress to determine, but certainly the suggestions that have been put forward this morning will be recorded for the information and guidance of that organising committee. We are very much indebted to Mr. Hood and to the other gentlemen who have spoken.

That concludes the business of this section.

Professor Cagli and M. Babin (in French). — I think I speak in the name of all those who have assisted at the meetings of this section of the Congress when I express our hearty thanks to Sir Ernest Glover, and also to Sir Maurice Fitzmaurice, for the masterly and impartial manner in which they have presided over our meetings. (*Applause.*)

The Chairman. — I thank you very much. I am very glad to have been able to preside at these meeting, and apparently to have given you some measure of satisfaction. The discussions have been very interesting, and I think we have laid the foundation stone of very much further discussion at the next Con-

gress. I should think, from what has transpired today, that you will be quite ready to have another Congress as soon as the organising body is able to arrange for one, to carry on the discussions which are now stopped by considerations of time. I thank you very much. (*Applause.*)

PROCEEDINGS

OF THE

SECOND GENERAL MEETING

CLOSING CEREMONY

Friday, July 6th 1923

The Rt. Hon. Lord DESBOROUGH, K.C.V.O. in the Chair.

The Chairman. — Ladies and Gentleman, we have now come very near to the end of our labours. The procedure this afternoon will be as follows. The Executive Committee has delegated to M. Antoine and to Mr. Griffiths and Dr. Isserlis the duty of reading the conclusions which have been formulated and accepted in the Sections, and endorsed by the Committee of the Congress, upon all the questions discussed at this Congress.

I should like to say a few words of explanation on the methods by which the Conclusions have been formulated. In order that the work of the Congress shall give the best results, it is not considered of such great importance to obtain definite conclusions as it is to have the questions fully discussed by the best writers, then reviewed by experienced General Reporters, then commented upon and discussed at the meetings of the Sections by those who have prepared the original papers and by any others present at such meetings, who may have valuable views and suggestions to offer and comments to make, and finally to have the results of all this consideration put into print so that they can be read quietly at home by each member of the Congress after the active work of the Congress is finished.

At the meetings of the Sections after the verbal discussions were finished, the recommendations of the reviewer were finally discussed by all the writers and speakers on each question, and

after the Committee had decided upon such phraseology as represented most completely the views of all parties concerned, the final recommendation, after having been translated into the two official languages of the Congress, so that its reading in the two languages shall give as nearly as possible identical ideas to all who may read them in any or both of these languages, is available in the copies now before each of you.

The Congress as a whole has now merely to decide whether the result in each case is satisfactory to the Congress. As the time has already passed for any changes except verbal alterations to make the translation perfect, or by which to express better the ideas which it is intended to convey to the reader, you will be asked, after the conclusions on each question as now adopted by the General Committee of the Congress shall have been read, whether they are satisfactory, and then, if there be no serious objections raised, the Question will be put as to whether the Conclusions shall be adopted by the Congress, the vote in each case to be « yes » or « no ».

By the bye-laws of the Congress, the Communications are never voted on in the Sections and are not read at this closing session.

We will commence with the *First Section*, which deals with Inland Navigation, and I will ask Mr. Griffiths to read the Conclusions upon the First Question, in English, and then M. Antoine to read the same in French.

Mr. Griffiths. — First Section. First Question. The following conclusions are submitted for the consideration of the Congress :

(1) « That in view of the shortage of fuel and its increasing » cost, it is necessary to develop water-power wherever avail- » able. »

(The Conclusion was put and carried unanimously).

Mr. Griffiths. — (2) « That this Congress, while primarily in- » terested in problems associated with navigation, recognises the » desirability of the establishment, when possible, of works both » useful to navigation and power purposes. »

(The Conclusion was put and carried unanimously).

Mr. Griffiths. — (3) « That whereas no universal rule can be » laid down and each case must be considered and treated on its » merits, it is desirable to take into consideration, if possible, the » requirements of all other interests affected, such as protection » against floods, irrigation, drainage, domestic water supply and » fisheries. »

(The Conclusion was put and carried).

Mr. Griffiths. — (4) « That for this reason it is desirable that » the water resources of a country should be under the control of » one authority, whose duty should be to guide the utilisation of » those resources in the best interests of the community. »

(The Conclusion was put and carried without dissent).

Mr. Griffiths. — (5) « All technical research work likely to throw » a light on the decisions which this authority will be called upon » to take is to be encouraged, especially if tests can be carried » out on canals having dimensions corresponding to modern » boats. »

(The Conclusion was put and carried).

The Chairman. — I think we might put all these resolutions together. If anyone objects we will take them seriatim, but otherwise I think we might take them *en bloc*.

Now we come to the Second Question.

Mr. Griffiths. — *First Section. — Second Question.*

« The dispositions or arrangements to be adopted to facilitate » the passage of boats through locks, by elevators, inclined pla- » nes, and other means of overcoming the differences of level de- » pend, taking into account the type of work adopted, on a number » of considerations, especially on the importance of the traffic, » the type of boats, the height of the fall, etc.

» It is not possible to give precise indications of this subject » which are applicable to every case.

» The following means appear, however, to be advisable as

» generally susceptible of facilitating and accelerating the operations.

(1) « A judicious location of these works in reference to the » alignment of the waterway. »

(2) « The provision at each lockhead of a lay-by provided with » guides, and large enough to hold all the boats to be passed » through at one locking. »

(3) « The adoption, on the one hand, of a sufficiently large relation between the respective water sections of the lock entrance and of the boats, and on the other hand, of a sufficient » excess of the available area of the lock chamber over the train » marshalled for locking. »

(4) « The adoption of appropriate means of traction. This essential point has not been solved satisfactorily in all cases, and » therefore further investigations and trials should be made, special regard being paid to locks of high fall. »

(5) « The introduction of mechanical working of the various » parts, wherever their dimensions and the volume of traffic » warrant it. »

(6) « The installation of lighting at the lock and in the vicinity, » allowing of working at night with safety and rapidity, when the » traffic is sufficient to warrant it.

» It is understood that in case of locks, these should be provided with proper arrangements for rapid filling and emptying » without producing currents which may cause disturbance, either » to the boats placed in the lock chamber, or to those awaiting » locking. »

* * *

« The Congress expresses the wish that the Permanent Commission of Navigation Congresses would submit for considera» tion, at the next Congress, the problem of overcoming great » differences of level, especially in those cases where water levels » vary. »

(The conclusions were then put *en bloc*, and carried without dissent).

* * *

The Chairman. — Now we come to the Ocean Section, and I will call upon Dr. Isserlis, to whom we are all so much indebted, to read the Conclusions.

Dr. Isserlis. — *Second Section. — 1st and 2nd Questions :*

« The XIIIth International Navigation Congress having read » and discussed the 24 Reports dealing with the first and second » question of the 2nd Section, namely : « The accommodation to » be provided for ships in connexion with the construction of new » works at Ports, in order to satisfy the future dimensions of » ships, and the types of works for berthing ships of great » draught in tidal seas », adopted the following conclusions :

1. « That with regard to the probable future dimensions of » ships, there is a tendency, for economic reasons connected only » with the cost of running, to a general increase in the draught, » but that, although the percentage of ships drawing 30 feet and » over is likely to be greater, this increase will be limited by the » characteristics of the principal channels and harbours of the » world, which should tend to check this increase in draught. »

2. « That there will be an increase in the average tonnage » more especially in that of ships of from 5,000 to 8,000 tons, but » not in the tonnage of the largest pre-war ships, in the very near » future. »

3. « That the accommodation to be provided for ships should » be guided by consideration of true economy, and that against » any anticipated saving in the cost of running a ship due to in- » crease in draught, the additional expenditure entailed at all » ports at which such vessels will trade, entailing the necessary » deepening of approach channels, berths, dock and wharf walls, » locks, dry docks, etc., must be taken into account.

» It has been shown in this connection by certain statistics » cited by the Reporters, that it may generally be considered that » estimates show that approximately the total cost of construc- » tion of a Port for works of the same kind increases as the cube » of the depth. »

4. « That the provision of the facilities for the rapid and eco- » nomical dispatch of goods on arrival at a port, is as important » as the provision of deep water, quays, etc., as the cost of handl-

» ing goods in the large sheds and wide quays necessary to fill » large ships to ensure quick despatch is an important item in » cost. »

5. « It may be useful in connexion with an inland Port, situated » at a great distance from the sea, to construct a Port of call for » Ocean liners near the coast, under the same administration as » to the inland Port. »

6. « That with regard to new and recently constructed work, it » is noticed that in certain instances 40 feet of water has been » provided for Atlantic liners, the depths provided for cargo ves- » sels generally has been much more modest, and it is considered » that as the trade of a Port is and will continue to be largely » dealt with in ships of moderate draught, the deep draught ships » should pay proportionately greater harbour dues. »

7. « That except for the Atlantic passenger service, it is consi- » dered that when everything is taken into account, it will be dif- » ficult to justify the necessity for a depth of water at the quay » side of more than 35 feet at LWOST for many years to come ; » while a Port providing 30 feet of water at LWOST would be » considered a first-class Port. »

GENERAL

8. « The Congress proposes that these questions, N^os^ 1 and 2, » be referred to the next Congress ; that in the meantime, each » nation should make an exhaustive study of this subject by the » representatives of the various interests concerned, namely : » Shipbuilders, Shipowners. Dock authorities, Dock engineers and » Railway administrations, and that it be an instruction to this » Committee to consider the question of establishing systematic » research in the whole subject of economic dimensions of ships » and Docks, as the want of co-ordination in the past seems to » have prevented the development of Ports and ships on economic » lines. »

Dr. Isseriis. — I must draw attention to one inaccuracy in the paragraph n° 1. The amended English text corresponding with the amended French text is as follows :

« although the percentage of ships drawing 30 feet and over is

» likely to be greater, this increase will be limited by the leading » dimensions of certain marine waterways and principal harbours » of the world. »

M. Perrier (in French). — Gentlemen, I have remarked that the text of the conclusions submitted to the deliberations of Congress differ slightly from that which was adopted after the discussion of the 2rd Section.

After the explanations and rectifications which have just been made, I rally willingly to the new wording proposed which does not implicate that the dimensions of the ships can be limited in the future by the Suez Canal.

As I have already recalled the Universal Company of the Suez Maritime Canal has always endeavoured to ensure the free and easy passage through the canal of all boats frequenting the Indian and Far Eastern seas and it has carried out to that end in due time the necessary works of widening and deepening the canal.

The Company has undertaken the execution of a new programme of works which will enable ships having at least a 35 foot draught to pass through the canal, notably exceeding the draught actually contemplated by the principal users of the canal, for the greatest ships likely to go through this navigable waterway and I am authorized to say that, if further requirements become manifest in the future, the Suez Maritime Canal Company will not fail to take, without delay, all necessary measures for giving to navigation all the desirable facilities.

M. Gevaert, President of the Permanent International Association of Navigation Congresses.

Gentlemen, concerning the inaccuracy remarked by Dr. Isserlis in the English wording of Conclusion n° 1, which inaccuracy was the reason for the justifiable remarks of Mr. Perrier, I wish to insist here on this fact that the Permanent Commission of the Association has come to an agreement on the English and French texts of the conclusion. Only, an inexplicable error of typewriting has got into the reproduction by duplicator of the English text. That which Dr. Isserlis has just read to us is exactly the English text which was drawn up by the Permanent Commission.

A Delegate. — What is the force of the phrase in the eighth section — « that it be an instruction to this Committee to consider the question of establishing » etc. ? I do not find any previous reference to a Committee. It seems a little uncertain as to whom this refers to.

Sir Ernest Clover. — I am afraid that is bad drafting. It should read « In the meantime each nation should appoint a Com- » mittee to make an exhaustive study, and that the Committee » should consist of ship-owners, ship-builders, etc. », and that « it » should be an instruction to that Committee of each nation. » I think we might amend that drafting to that extent.

It would read best if we said « In the meantime, each nation should make an exhaustive study of this subject by a Committee consisting of the representatives of the various interests ».

The Chairman. — With these drafting amendments I will put these various Conclusions to the Congress.

(The Conclusions were then put and carried unanimously).

Dr. Isserlis. — *Second Section.* — *Third Question.*

(1) « In most cases it is preferable to use port equipment for » the handling of bulk cargoes. Speaking generally, port equip- » ment is, from the point of view of efficiency, preferable to ship » equipment. It appears to us essential, however, that all ships » should be supplied with equipment adequate for their usual » trade.

(2) » The problem of mechanical equipment of ports for the » handling of freight is too complex to be dealt with in general » terms.

» In all cases where mechanical equipment can be economically » installed, it is desirable that his should be done, as it permits » of a quicker and cheaper handling of cargo.

» The details of such mechanical equipment must necessarily » depend upon the needs and possibilities of each individual » port. »

The Chairman. — I will put that resolution to the meeting.

(The resolution was then put and carried without opposition).

The Chairman. — Now we have a recommendation.

Dr. Isserlis. —*Recommendation from the Second Section.* — « The Second Section proposes that careful studies concerning » the accommodation for the reception and storage of liquid fuel » be invited for consideration at the next meeting of the International Navigation Congress, and recommends that at the next » Congress more time should be devoted to problems connected » with lighthouses and signalling. »

The Chairman. — We do not vote on that.

Mr. Griffiths. — There are two recommendations from the *first section*, as follows

First Recommendation. — « Considering the importance of the » acquisition of complete information of the regime of both surface water and subterranean water for navigation (rivers, canals and mixed canals), power, agriculture and all other interests, this Section of the Congress is of the opinion that it is » desirable that :

» 1. An International Committee be set up :

» (a) for the purpose of compiling the records relating to this » subject which have already been obtained.

» (b) to consider and decide upon the best methods to be employed in obtaining reliable information on these subjects in » the future, with the object of making recommendations for the » adoption of methods as uniform as possible, of measurements, » and for the collection of records.

» 2. That in the meantime Authorities in all countries should » be urged to study this question with a view to arriving at the » best method of procedure. »

Second Recommendation. — « That this Section of the Congress » desires to emphasise the desirability of the Permanent Com-

» mission taking steps to give effect to the wishes already ex-
» pressed at former Congresses ; that an International Statistical
» Committee be appointed, with a view to the unification, as far
» as possible, of inland navigation statistics. »

The Chairman. — Those are communications, and they are not voted upon, but for the information of the Congress it was thought well that you should be made aware of the decisions which have been arrived at. The collection of statistics has been very often voted on by these Congresses, but has not been carried out. It is hoped that some steps will be taken to get it carried out. I think the Thames Conservancy are about the only body who really do supply these statistics with regard to rainfall, and so on, over a given area.

It now gives me great pleasure to call upon some of our foreign visitors to address the meeting.

I believe we have here M. Timonoff, who was the President of the last Congress held in Russia. I hope he will say a few words later on.

Capt. F. Chambers (United States of America). — Mr. President, fellow delegates and members, ladies and gentlemen, When General Bixby, the head of our American section of the International Association, asked me to write two papers for the Congress I was almost overwhelmed. When he asked me, a little later on, if I would not come as a delegate and as a substitute member of the Council, I was almost speechless. Now that I am asked to speak for the United States, and for my fellow delegates at the closing of the Congress, I hardly know how to express myself. However, it falls to my lot to represent our delegates who have been with you for this time. I have talked to them throughout the Congress, and I find a unanimous sentiment to the effect that we have been made to feel very much at home, and I take it that is absolutely the definition and the height of hospitality. I want to say also that we have had the same relationship to those who, with us, are guests of the British Organising Committee. We all owe that Committee, the Authorities of Trinity House, the London

Chamber of Commerce, and the various other associations and organisations which have contributed to our pleasure and profit, a very great vote of thanks. I wish to convey the feeling for my associates that we are very grateful, and that we regret to say good-bye. I would like to say, further, for the American Association of Port Authorities which I also represent, that on its account I appreciate the many courtesies extended. Since it seems impossible that we should in the near future in America have the Congress (we could hardly hold the 14th Congress since we had the 12th) I hope we may at least meet you individually in the very near future, and that, in view of important communications before the Ocean Section and the circulars which have been distributed as regards co-operation and co-ordination in the design and equipment of ports, I may hear from a great many of you individually. I do hope that some of you at least may affiliate with our American Association of Port Authorities, which has a wide distribution of its membership, and which at the present time has a very active, congenial and competent Canadian President. Finally, I must say for my colleagues and myself, not good-bye, but *au revoir*. (*Applause.*)

M. Maese y Pena (Spain) (in French). — My Lord President, Ladies and Gentlemen

In the name of the Spanish Delegation, I have the honour to address you and I take advantage of the opportunity to express to you our hearty thanks for the really affecting welcome which we have received in England and especially from The President, the Organizing Commission and all the corporations and personalities who have honoured and overwhelmed us with their kindness and attention.

The organization of the Congress was perfect, the questions submitted were profound, and learnedly discussed, and the results will no doubt be of great importance for the advancement of science and industry relating to navigation.

We are sure that in future Congresses, several questions which, considering the actual state of knowledge must be re-examined, will be solved in a definite manner and that these Congresses will

continue to render most important service for the benefit of humanity.

M. Babin (France) (in French). — Mr. President, Ladies, and Gentlemen, In the name of the French Delegation, I have the honour of addressing our heartiest thanks and our most respectful homage to H. M. King George V who has taken the XIIIth Congress under His High Patronage.

I address also our thanks to the British Organizing Committee, to its eminent President Lord Desborough, to its very distinguished Vice-President, Sir Maurice Fitzmaurice, to Sir Ernest Glover, Sectional President, to Mr. Dunwoody, General Secretary of the Committee, who have so kindly received us and directed our work with so much distinction.

It was a great joy for us to participate in this Congress of peace and work which has taken up again so brilliantly the traditions interrupted by the war.

We have been happy to examine with you the great problems which present themselves from the double point of view of technics and economics.

Already 30 years ago, in 1893, we had come to discuss with you, at the 2nd Congress of Maritime Works, similar questions, under the presidency of the eminent Lord Brassey, President of the Naval Engineers Society, of which we retain affectionate memories. And it is with the greatest pleasure that we have found again, among the reporters of the XIIIth Congress, two of the reporters of 1893 : — the general inspector Luiggi, here present for Italy; Mr. Blondel, Chief Engineer, for France.

We particularly thank the 2nd Section which on the proposal of Mr. Van Braam van Vloten, has kindly sent to Mr. Blondel, unable to be present owing to illness, the expression of its great sympathy.

The XIIIth Congress which is terminated to day will be counted among the most important owing to the amplitude and diversity of the questions dealt with. No other Congress has given occasion for such a large documentation, and reports so complete, and it can be said that the questions were dealt with under all their aspects.

I hope that this work of peace will bear its fruit, and will contribute still more to strengthen the ties of friendship which unit Great Britain and France, and will bring to all the Nations which are represented here, new elements of prosperity.

We shall always have most pleasant memories of the generous hospitality which you have accorded us and of the XIIIth Congress so brillantly organized, and which has exceeded all our expectations, and we hope to be again reunited in the XIVth Congress.

M. Ingianni (Italy). — My Lord, On behalf of the Italian Government, of the Italian Delegation, and personally, I wish to express the warmest gratitude to your Lordship, to the British Government, to Sir Ernest Glover, to the British Organizing Committee and to the Institution of Civil Engineers for the kind hospitality you all have shown towards us and for the perfect organisation of the present Congress.

I have had many occasions to be in touch with the British Government and British people, among which I find many of my best friends, so that I am very well acquainted with their kindness and courtesy and high qualities.

During the present Congress I and my colleagues have once more appreciated such distinguished qualities, and we feel more heartily connected with Great Britain.

This Congress has very well succeeded in the important task, and I feel obliged to congratulate all the gentlemen who have given the assistance of their experience and intelligence to the work which has been done. I particularly congratulate your Lordship and the other British members. You deserve the essential merits of the success of the Congress.

Upon the International Congresses my opinion decidedly differs from that of those people who do not think them of practical importance. Besides the interest of a large exchange of views, these Congresses give to all their members the opportunity of being personally associated and to deal with every question with a spirit of real friendship. And that is a great result with regard to the peace of the world.

Mr. T. Harada (Japan). — Mr. President and Gentlemen,

It is my pleasant duty, and also an honour, to address a few words to you on behalf of the Japanese Delegation. First allow me to say how much we have been impressed by the great success of the 13th Congress, not only on account of the enormous influence which such a Congress must undoubtedly have upon the progress of science, but also because it accomplishes so much at the same time for the promotion of international understanding and friendship. I hope that there will be no nation unrepresented on the occasion of the next meeting of this important and beneficent Congress.

Although Japan has an ancient origin, her doors were only opened freely to international intercourse about half a century ago. Since then she has tried her best not to lag behind and also to do her utmost for the common good. She is now improving her rivers and harbours and accumulating a store of maritime and waterways experience, especially as regards hydrodynamics. Though Japan is still a young scholar, we venture to hope that the day will soon come when she may be able to place her scientific researches, as she will feel it an honour and a duty to do, at the services of this Congress.

In conclusion, may I express our respectful thanks for the Royal Patronage with which our Congress was honoured by His Majesty King George. I also desire to thank most sincerely those other distinguished patrons in this country and, also to say how much we are indebted to the strenuous and well-concerted labours of all those officials of the Congress who have been instrumental in securing its unqualified success.

My powers of language are insufficient to express our thanks, so I will only add that I cordially endorse what my predecessors have so ably expressed in regard to our appreciation of the courtesies and of the hearty welcome extended to us by this nation, the old friend of Japan, and by the people of this great metropolis.

M. Wortman (Holland). — We have profited by the discussions which we have held. We are thankful that we have come to London, and we are thankful for having been received with so

much courtesy and cordiality, for which the British people are famous.

I have to express our thanks to those who have received us here. I also wish to thank the British ladies who guided and entertained our ladies in such an extremely courteous way.

M. Timonoff then spoke in French.

Mr. President, Ladies and Gentlemen.

Called upon unexpectedly to speak to this honourable assembly, I cannot help making an observation on the origin of our Congresses, and it is to Belgium that I express my heartiest thanks.

It was in 1885 that the Belgians had the admirable idea of reuniting in an International Congress the persons interested in science relating to navigation. It was then that our Congresses originated, and it is still to Belgium and to Belgian initiative, that we owe the constitution of the Permanent International Association of Congresses, I bow with respect before this remembrance.

Then, it is to all the nations which have had the amiability — I might say the intelligence — to reunite the Congresses in their countries, that we must express our gratitude. These Congresses constitute a part of the scientific Congresses which had all the same ideal : it was the ideal of universal peace. Like every ideal, it is evident that we were not able to attain immediately the object we had in view. The world has been convulsed by the great catastrophe which has just come to an end and of which the results are not yet settled. But we are sure that the work of men of science, men of navigation, men who are convinced that it is by international union that universal peace may be obtained, we are sure, I say, we are marching in the way of peace.

It is with a sentiment of great respect that I bow before the representative of His Majesty's Government who has kindly wished to reunite us in the greatest port of the World for this Congress.

Let me terminate my speech by expressing my heartfelt thanks to the Institution of Civil Engineers of London who have kindly lent us their premises, according to the traditions of English engineers.

For centuries England has been and will remain the first mari-

time nation of the world, and England has kindly desired to help us.

I think that you will be unanimous in expressing our most respectful thanks and our gratitude to the President of Congress.

Colonel Hansen (Sweden). — Mr. President, My Lord, Ladies and Gentlemen, On behalf of the Delegations from Denmark, Finland, Norway and Sweden, I have the honour to express our sincerest thanks for the instructive and charming days we have spent at the Congress and for the splendid and cordial, really English, hospitality which we have met and enjoyed, and I am quite certain that the remaining days will be still more pleasant, if that is possible.

The geographical situation of our countries, with their enormous coast lines, makes the use of the sea as means of communication with other countries an absolute necessity.

Navigare necesse !

Amongst these maritime communications our commercial relations with England have of old been most important. A thousand years ago our ancestors, the Vikings, came over to your shores in their tiny crafts, sword in hand, to claim — I am afraid in a rather illegal manner — tribute of English goods and other valuable treasures.

In our days we still demand good English goods, but we are — in a more civilised way — prepared to pay for them in wares, raw materials and products appreciated by your countrymen.

Thanks to the enormous technical progress made during the last centuries the sea is no longer a dangerous barrier separating the different countries, but has proved an admirable connecting link between them.

We Scandinavians have always worked with this in view, our merchant marines, especially that of Norway, are very considerable, and we have all of us made serious efforts to improve our harbours and waterways. We have large steam ferries, carrying goods and passenger trains on board, running between Sweden, Denmark and Germany, and a complete plan has been worked out for a great steam-ferry connection between Gothenburg and Eng-

land. Good sea connections exist already between our different countries and also to foreign ports, but we are energetically working to their further development. Copenhagen, since several years ago, owns a free port, extremely well constructed, equipped and managed. Sweden has during the last years constructed and opened the three modern free ports of Stockholm, Gothenburg and Malmö.

In Sweden the inland canals of Trollhättan and Sodertälje have been greatly enlarged, thus opening the big lakes, Vänern and Mälaren, for sea-going vessels. Finland, the country of a thousand lakes, has planned similar development of its considerable net of inland canals and waterways.

Under these circumstances it is only natural that we, as old seafaring nations, take part in the work of the Association with the deepest interest. Sweden had hoped to welcome the Thirteenth International Navigation Congress to Stockholm. Our hopes were not realised, but let me express our great satisfaction that a Congress has been arranged again after a break of eleven years and that this Congress has been held here in London, of old the world's capital of shipping.

We beg to thank the eminent organisers of the Congress most heartily, not only for the 5 1/2 tons of printed papers, and for the discussion of them — how useful those are — but also for the personal relations we have had the pleasure to form with so many distinguished delegates of different nations, and last but not least, with the representatives of that nation which created the word gentleman, and shewed how to live up to it.

We wish that the work of the Thirteenth Congress of Navigation may effectively help to facilitate and develop the means of communication by water, thus also developing the communications of soul and mind between all nations, the best, the only way to further the Peace of the World and the prosperity of mankind.

Mr. President, allow me at last to add a few words as delegate for Sweden. Let me express — and I think that all my countrymen will join me in this — our extreme satisfaction that H. R. H. The Crown Prince of Sweden has in these very days chosen his bride from England. I am convinced that this will greatly

strengthen the ties of sympathy already existing between our northern country and the great British Empire.

M. Gevaert, General Director of Roads and Bridges and one of the Presidents of the Permanent International Association of Navigation Congresses, closes the series of speeches.

He declares that he finds himself in the embarrasing situation of one who associating in a family party and having to offer in his turn a bouquet of flowers to the heroes, finds the garden, where he goes to gather them, stripped by those who have gone before him to prepare their offerings.

All the resources of rhetoric having been so brilliantly utilized by the speakers who have preceeded him, he is reduced to express in a dry and colourless speech the sentiments which animate at the end of the session, the members of the Permanent International Association and particularly the Belgian Delegation at the Congress.

These sentiments are first of all, a profound gratitude towards the Institution of Civil Engineers, which has kindly wished to put its premises at the disposoal of the Congress, and has made its guests feel so much at home as to give them the illusion of being the rightful occupants of its Palace.

M. Gevaert then points out the rôle performed in such a masterly manner by the President of Congress, The Right Honourable Lord Desborough, who has instilled into the work such remarkable activity and must be considered as one who has contributed the most to its brilliant success.

After which, passing in review those who with Lord Desborough have principally taken on the task of making a success of the great work of the Congress, he applauds the names of Sir Maurice Fitzmaurice, Deputy President, of Sir Ernest Glover, Bart. who has directed the debates in the 2nd Section with an authority which his exquisite courtesy alone could equal, and Mr. R. B. Dunwoody, the General Secretary so competent and so obliging.

Mr. Gevaert concludes by declaring the London Congress, which has put together again the chain which the war had brutally broken, will be marked in the annals of the Permanent International Association.

He expresses the hope that the future Congresses will be the equal of the one which is going to close in the apotheosis of a brilliant success.

The Chairman. — I can assure you that whatever qualms I may have had during the last year, when I had to answer the very numerous communications of that most indefatigable slave of this organisation, Mr. Dunwoody *(Applause)*, and whatever qualms I may have had, night and day, in carrying on a most gigantic correspondence in connection with our efforts to try to make this Thirteenth Congress a success, they have been swept away first of all, by the very kind words which have been spoken this morning, and, secondly, by the splendid reception which had been given me on more than one occasion by the Members of this Congress. Perhaps I did something ; at all events, I tried to do something. I was successful in getting the patronage of His Most Gracious Majesty The King and also the presence here of the Duke of York. I happened to see the Duke of York the other day and he told me he was most sincerely pleased to have been present on the occasion of the opening of this Congress and that he was very greatly impressed with the importance of the Congress and with the personalities of the engineers whom he saw gathered together there. I too, should like to add my humble tribute of thanks to Sir Ernest Glover, the Chairman of the Ocean Section, who never left his post. He was like the boy on the burning deck. I am sure the Ocean Section knows how much it is indebted to Sir Ernest Glover. Then there was Sir John Purser Griffith and Mr. Sydney Preston, who helped me with my struggles with inland waters. I hope the results of our deliberations will be of some permanent use to engineers, both by sea and land. One gentleman rather chaffed us about the tons of literature. The weight is even more than he said, I think. I have tried to make calculations and I think it comes to something like 6 1/2 tons Each delegate did not get 6 1/2 tons, but if you count all the foreign delegates of the twenty-seven different countries, it comes out at something like that. I have been much impressed with the excellence of the material contained in that 6 1/2 tons

As I was coming here just now somebody asked me what struck

me most as regards the Congress. Two things strike one. This is the first Congress at which some of the finest brains in every country in Europe and elsewhere have been turned from war to peace. Those energies which were freely lavished during the war are now, for many years to come we hope, turned in the direction of peace, and are now engaged in improving those opportunities so freely lavished by Nature upon almost every country. The second thing that struck me was this. Although the delegates have come from almost every country in the world and although they had strong differences of opinion which they did not hesitate to express, yet our deliberations have been conducted with the greatest possible harmony throughout the whole of this Congress. *(Applause.)* Whatever the delegates may have privately felt at some excited moment, I do not think there has been one word of anger uttered from last Monday until the present time. Although they may not go into very great detail, we have at all events, come to certain large and broad conclusions which I think will be a great guide to engineers in time to come.

Ladies and Gentlemen, it has been a very great source of pride and of pleasure to me to have been elected President of the Thirteenth Congress. *(Applause.)*

Sir Maurice Fitzmaurice. — May I take up your time for only one minute while I propose a vote of thanks, on behalf of the British Organising Committee, and also on my own account, to Lord Desborough for all the work he has done. I have been a sort of odd man at this Congress ready to do anything that came to my hand, and in that way I have seen exactly the large amount of work which Lord Desborough has done. Furthermore, I know that he ought to have been at Henley most of this week but he has deliberately turned his back on Henley and stayed with us. I am sure there has been great disappointment at Henley at his absence, but there has been great joy here at his presence.

Sir Ernest Clover. — I rise with the greatest possible pleasure to second the vote of thanks to Lord Desborough. We are all indebted to him very much for the work he has done.

Whilst I am on my feet, I should also like to thank M. Gevaert

very sincerely for the kind words he said about me. Our President, I am afraid, has exaggerated what I have done, because I have to thank Sir Maurice Fitzmaurice for taking my place for a whole morning. On that occasion I was not on the « burning deck. »

The only other thing I should like to say about the Second Section is this. It gave me great pleasure to preside because I found that I was so extremely well-supported by all the gentlemen from the different countries who attended this Meeting. Without their cordial assistance and without the help of Dr. Isserlis, who was at my side all the time keeping me right, I am afraid we should not have done as well in the Second Section as apparently you seem to think we did. However, this is getting away from the point to which I rose, which was to second the vote of thanks to our President

The resolution was then put and carried with acclamation.

The Chairman. — Ladies and Gentlemen, I will not inflict another speech upon you, but I cannot close this Congress without expressing on your behalf our very great thanks to Sir Maurice Fitzmaurice and Sir Ernest Glover, to all the writers of the excellent papers to the General Reporters, to M. Lambin and his most excellent staff for the good work they have done all through this Congress, to Dr. Isserlis, who has acted as Secretary to the Ocean Section and to Mr. Griffiths the engineer of the Thames Conservancy Board who has acted in the same capacity in the other Section.

I now declare this Congress closed May its good work be carried on, and improved upon, by future Congresses. *(Applause.)*

The Proceedings then terminated.

LECTURE

REPORT

Lecture by Professor Ing. ANT. SMRČEK Brno (Czechoslovakia)

Experiments with models of fixed and movable dams, made in an experimental channel in the hydraulic Laboratory of the High Technical School in Brno (Czechoslovakia).

Gentlemen,

With your permission I beg to call your attention to the experimental hydraulics considered as an applied science which is to serve in engineering.

The engineer wishes to determine as exactly as possible the dimensions of the work which he has to establish and verify then if the dimensions are convenient.

He often hesitates in what manner f. e. the form of the dam is to be designed, and the dam secured from undermining by the water flowing over its crest.

Until the present time the form of a dam has been designed mostly empirically according to the similar constructions made and tested in nature. But for dams with a greater difference between head and backwater which are often used now, there are not sufficiently proved examples at hand.

Some of them have not been tested, the others have been undermined by water and destroyed.

About the causes of these facts we have only suppositions because in nature we generally see the surface of the flowing and whirling water. The actions underneath and the proper causes of the interior motion of the water and of the undermining, are impossible to be researched and measured with accuracy. After the flood has fallen, it is possible to state only the result of a course of varying stages of the flood, but not the effect of differ-

ent heights, especially the critical head of water which has caused the dangerous undermining of the dam.

Until now it is impossible to determine the most advantageous form of a dam by hydrotechnical calculations. A systematical experimental work is therefore important either in great dimensions in the nature or in an adequate adapted hydraulic laboratory with models of suitable dimensions.

On that basis experiments were made by Engels, Rehbock, Nagler and others intending to found the law of analogy between the model and the reality.

Preliminary and comparable experiments were made with sinusoidical dams of equal forms but different dimensions in the proportion 1, 2, 4, then with different types of masonry dams.

Wishing to investigate the influence of the form of a dam upon the action of overflowing water, we have proceeded as follows :

The experimental models of reinforced concrete dams with a polished surface were set in a prepared sand-foundation so that the crest of the dam was precisely horizontal and perpendicular to the axis of the hydraulic channel.

The first comparison was the model of the new Helmovsky dam in Prague in the proportion 1/50, the height of which, between the top and the bottom is 4,36 m., therefore on the model 8.72 cm. in height. This height was maintained with nearly all the following types.

The overflowing water rose successively and proportionally above the crest during a time approximatively the same as it was necessary for the stabilisation of the excavations on the bed of the river. The form of the wave, the whirls of water, of sand and of airbubbles as well as the motion of material on the ground were photographed during an intensive illumination and graphically registered with different colours in projection on the plate-glasses, then copied on a transparent paper for further purposes. Numbers in centimeters signify the real dimensions of the model.

In the same way models of movable weirs were experimented in order to ascertain the form and effect of different combinations of the stream on the jump and to get the most suitable form of

it which would weaken as much as possible the destructive influence of the flowing and whirling water upon the bed of the river.

* * *

I regret not to be able to give the projections of dispositions of dams, nor to show the large new photographs of our experiments. All was detained at the customs, nobody knows where.

For this reason I can only demonstrate a film from the hydraulic Laboratory of the High Technical School in Brno (Czechoslovakia) and some experiments with different types of fixed and movable dams, executed in the hydraulic channel.

The laboratory is used for scientifical researches concerning the physical influences of water especially upon the hydraulic constructions and river-beds. Besides it serves for instruction and information of young engineers.

The first step towards the establishment of this laboratory was made in 1914 and after great difficulties caused by the great war its construction was finished in 1916. For want of means and place the laboratory was made in a simple but quite sufficient manner.

I

1) *The action of overflowing water on the floor below* the dam experimented in the hydraulic laboratory of Prof. Ant. Smrcek on the High Technical School in Brno.

2) *Turbopumps of 100 and 150 l. s. lifting the water into the distributing-tank.*

By means of these turbopumps it is possible to let circulate nearly 250 l. s. of water, lifted from a well communicating with the tailrace.

3) *The distributing tank equipped with a crest of 52 m. in length.*

The tank with a crest of 52 m. in length is necessary in order to get constant pressure of water. The superfluous water runs back into the well through a tube which serves at the same time as a supporting column.

From the distributing tank water is directed by two tubes with stop-cocks reaching into a quieting tank placed before the measuring crest in the fluvial and hydraulic channel.

4) *Measuring crest, triangular and rectangular.*

The Poncelet's measuring crest has an edge exactly 1 m. in length, the Thomson's triangular crest has two cathetes making a right angle. The elevation of water is marked on the paper which is fixed on the vertical cylinder of a limnigraph constructed specially for this purpose, and moved more or less rapidly by a small electric motor. The seconds are registered by electro-magnets operated by the chronometer of the Geodetical Institute.

5) *The experimental fluvial channel.*

The fluvial channel is used especially for experimenting on models of rivers. It gives the possibility to study the action of different types of constructions : locks, water-power plants, etc. as well as the influence of the position of these constructions upon the floor. Its total length is 21.22 m. of which 18.19 m. are suitable for experimental purposes. Its breadth is 3.50 m. and its depth 0.62 m. The retained water is advantageously utilized for experiments in the hydraulic channel.

7) *The tank for sand with the returning channel which is at the same time a tank for the circulating water.*

The water of the fluvial channel flows through the cylindrical gates into the returning channel or into the sewer. The water of the hydraulic channel flows directly into the returning channel and towards the well from where it is lifted by the turbopumps for further circulation.

8) *The hydraulic channel with plate-glasses in which a model of a double bear-trap is placed.*

The hydraulic channel equipped with 6 pairs of polished plate-glasses is used for hydromechanical experiments on different models of constructions of fixed and movable gates, rock fill dams, etc.

As to these experiments it will not do to observe only the phenomena on the water surface. It is necessary to study especially the phenomena under the surface f. e. the filtration of water, its interior motion, the whirlpools, the action of the air-bubbles dri-

ven under the water-surface, the motion of the material on the bed of the river, and the results of the excavating action of water upon the ground.

The channel is 17.14 m. long and exactly 1 m. broad and 1.05 m. deep.

9) *A dam with double gates. Overflowing water. Water discharging on the bottom and in the middle, its action upon a ground which is easy to be excavated and is protected by a concrete floor.*

It is a model of a great dam with double gates in Strekov on the Labe River for a head of 6.53 m. This form of the floor streamdown the dam has given, after some experiments, the best results as to protecting the ground from undermining by the waterstream, the crest being in different positions.

We see the whirlpools, the air-bubbles and the whirling of materials.

A man who should unfortunately fall into this whirlpool, would be inevitably lost without the slightest possibility of saving him.

II

10) *Types of old dams of Prague. The original ground is marked by a black horizontal line. The numbers indicate the height of the model in centimeters.*

The types of old dams in Prague were not bad, especially during the flood, because the floor is far enough from the bottom of the dam.

11) *A vertical dam without protection against undermining.*

The gravest inconvenience of the vertical dams is to be looked for in the very great difficulty of protecting them against undermining which takes place streamdown and is caused by the discharging water whirling and undermining the dam, if the water rises to a height of 4 cm. above the crest.

12) *Dam protected with sheet-piles. If undermined, it falls down into the excavation. Shortly afterwards it is covered with sand and the ground becomes even.*

It is the same vertical dam protected with a concrete wall

against undermining. With the increasing quantity of water characteristic great excavations are formed on the bottom of the dam which cause that the wall and the dam tilt and finally fall down. In a short time all is covered by sand carried by the stream.

13) *The floor of a dam, secured by swimming beams. During the flood they do not sufficiently protecting the ground against undermining.*

The swimming wooden beams protect the ground of the dam against undermining only if the height of streaming water during the flood is not too great. With increasing flood the swimming beams are pressed down by the water discharging in the direction of the ground and they cannot protect it any longer against undermining.

III

14) *A sinusoidical dam. During the increasing flood we see tumultuous and periodical whirlpools on the grounds.*

The floor of a sinusoidical dam has a convenient length, and the whirlpools of the overflowing water cannot destroy the dam.

Very interesting are the periodical revolutions of the gravel on the bed, whereas the surface remains relatively quiet.

15) *Protection of the floor by means of sheet-piles which is not too effective.*

We see how the undermining advances from the first sheet-pile to the third, taking the shape of an excavation which occurs under the same circumstances in the bed of a river without any protection.

16) *The type of a fixed shortened sinusoidical dam. It is undermined in a short time.*

This type reminds the destruction of some shortened sinusoidical dams f. e. in Austin on the Colorado River. It is chiefly the shape of the floor that causes the destruction of the dam.

17) *The fixed dam is protected from undermining by means of a floor. The water under the vertical wall is nearly calm during the flood and the current deposes sand and stones here.*

In order to protect a vertical dam from undermining, a con-

crete or masonry floor of different forms is constructed. The choice of a suitable form of such a floor is very important, because some floors were destroyed after being undermined and the excavations progressively increased till the destruction occured.

We can see to what height of overflowing water this form of the floor is effective. During the flood the water below the wall is nearly calm and the current deposes sand and whirling stones here.

To compare what a great influence the height of overflowing water above the bed of the river has upon the depth of the excavations near the bottom of the dam, and what is the effect of the overflowing water upon the different forms of the floor, I take the liberty to demonstrate a serie of photographs, made according to the experiments in our laboratory.

IV

18) *Protection of the dam from undermining by means of a fixed wall, constructed on the floor.*

This is the dam of our type Nr. XXI. with a fixed wall constructed on the floor, which has given the best results in protecting against the influence of the overflowing water. The excavation remained far from the bottom of the dam.

Very interesting for hydraulic installations is the lowering of the surface of the backwater during the period of the flood. The increase of height at the surface of backwater near the bottom is according to our experiments greater than at the dam with a descending floor, experimented by Prof. Floyd A. Nagler in the hydraulic laboratory in Iowa, Io., U. S. A., 1921.

19) *The dam of Prof. Rehbock. Sideview and view from above. During small floods the water becomes calm on the masonry floor, but during extraordinary floods a long narrow wave undermines the movable bed of the river.*

In order to control the results of the researches of the dam of Prof. Rehbock in Karlsruhe, which has been designed and built on the Sihl River in Zürich, we have made experiments with this type under the same conditions in our laboratory as in Karlsruhe, except only that the bed of the river streamdown the floor is not

protected with masonry. The results of these experiments were the same as those of Prof. Rehbock.

A great deal of water energy is dissipated on the masonry floor. A long and narrow wave is produced if the water rises a little, and the wave lasts some moments when the water begins to fall.

Gentlemen,

Besides the experiments just demonstrated we have made a great number of other scientifical and practical experiments in our laboratory. Among the latter may be mentionned the stating of causes which led to the catastrophe of the earth-dam at Bilâ Desnâ in Bohemia, then experiments with rock fill dams: how they resist the water-pressure; how much water may overflow without causing any damage; when and how the rupture occurs; which should be the best type of the cascades of the great dams, etc.

The desirable success makes it necessary to do the experiments in the laboratory very precisely and according to a plan, so that it would be possible to give formulæ of more general laws; the engineer has then but to verify them into more complex conditions and apply them.

The phenomena created in a laboratory cannot of course equal those in nature, and it is necessary to generalize the laws obtained in the laboratory by verifying them in a large scale.

But if we compare the experiments with reality we shall surely come to a more profond knowledge of the laws of ressemblance, and shall be able to conclude with a sufficient exactness of the experiments on the models that their application in a larger scale responds to our expectation.

Gentlemen,

I beg to claim your attention for a few more minutes only, in order to show you some views of the Canalisation of the rivers Vltava (Moldau) and Labe (Elbe) in Czechoslovakia as example of canalisation works with use of movable dams.

At *Mirovice* on the Vltava, the dam of the navigable channel

is suspended to the bridge of the national road. In other places have been used on this waterway movable trestle dams with needles or wickets. The distance between the trestles reaches up to 4 meters.

The lateral canal of the Vltava near Vranany secures the navigation towards Horin, on the Elbe, through a lock with a fall of 9 meters, which, established in 1904, is one of the greatest works for inland navigation on the European Continent. The doors and sluice-gates of this lock are worked by electric motors.

At Melnik, on the Elbe, locality known for its cultures of wines originating from Burgundy and Champagne, a large harbour is actually under construction.

This film shows a few dams and locks of the *Middle Elbe*, in a fertile country, with a flourishing industry, amongst other that of sugar.

In that section of the middle Elbe have been used new types of movable dams with an upperbridge, which, before the flood, goes up above the highest water level.

Gentlemen,

Czechoslovakia actually endeavours to follow the regulation and canalisation works of the Middle Elbe in 23 places between Melnik and Jaromer. Let us hope that after the disturbances of the world war, the necessary time shall be found to complete not only the canalisation of the Elbe upwards to Pardubice and Jaromer, but also to realize its junction to the Danube near Bratislava.

ENTERTAINMENTS AND EXCURSIONS

DINER GIVEN BY THE BRITISH GOVERNMENT TO THE CHIEF DELEGATES

The principal delegates attending the Congress on behalf of the various Governments were entertained to dinner by the British Government at Lancaster House, St-James, S.W., on Monday evening, 2nd July. The Rt Hon. Sir John Baird, Bart., C.M.G., D.S.O., M.P., His Majesty's First Commissioner of Works and Minister of Transport presided, and in addition to M. Gevaert, President of the Permanent Association and The Rt Hon. Lord Desborough, K.C.V.O., President of the Congress, there were also present Colonel Wilfrid W. Ashley, M.P., Parliamentary Secretary to the Ministry of Transport; Sir Maurice Fitzmaurice, C.M.G., F.R.S., Deputy President of the Congress; Sir Ernest Glover, Bart., Chairman of the Ocean Section; Sir Cecil Hertslet, K.B.E., British Representative on the Permanent Council; Captain Sir Acton Blake, K.C.M.G., K.C.V.O., Deputy Master of Trinity House ; Mr. Marshall Stevens ; Mr. J. R. Brooke, C.B. ; Colonel J. G. Baldwin, C.B. ; Mr. L. H. Savile ; Mr. T. M. Batchen ; Mr. G. E. Baker ; Major T. E. Gullick, M.C. ; Mr. F. C. Greene ; Mr. F. W. Emett, O.B.E. ; M. A. Lambin, General Secretary of the Permanent Association ; Mr. R. B. Dunwoody, O.B.E., Honorary Secretary of the British Organising Committee and the chief delegates representing the various Governments of the countries represented.

Sir John Baird proposed the toast of « His Majesty The King » and the toast of « The Sovereigns of the Kingdoms and the Presidents of the Republics represented at the Congress », after which in proposing the toast of the Guests he extended a most cordial welcome to the delegates attending the Congress. His Majesty's Government recognised the great value derived from meetings of experts on various branches of navigation by sea and inland water and he felt sure that the deliberations of the Congress about to take place would prove of immense value to all engaged in such work.

M. Gevaert responded on behalf of the Delegates, all of whom subsequently attended a reception given by the Government to the delegates and members attending the Congress and the ladies accompanying them. The guests had an opportunity of viewing the contents of the London Museum. During the evening a programme of music was performed by the band of His Majesty's Royal Artillery.

Banquet given by the British Organising Committee to the Delegates and Members and Ladies attending the Congress held in King Edward VII rooms, Hotel Victoria, London, on Tuesday evening, 3rd July, 1923.

A Banquet was given by the British Organising Committee to the delegates and members attending the Congress in King Edward VII Rooms of the Hotel Victoria, London, on Tuesday evening, 3rd July, 1923. The Rt Hon. Lord Desborough, K.C. V.O. (President) presided over a very large and distinguished gathering. In addition to M. Gevaert, President of the Permanent Association of Navigation Congresses and the Chief Delegates of the various Governments represented at the Congress, there were also present :

The Right Hon. Neville Chamberlain, M.P., Minister of Health; Sir Maurice Fitzmaurice, C.M.G., F.R.S., and Lady Fitzmaurice; Sir Cecil Hertslet, K.B.E., British Representative on the Permanent Association of Navigation Congresses; Sir Algernon F. Firth, Bart., Ex-President of the Association of British Chambers of Commerce; Sir Alfred Yarrow, Bart.; Sir Ernest Glover, Bart., Chairman of the Ocean Section; Sir Herbert Walker, K.C.B., General Manager of the Southern Railway; Sir Acton Blake, K. C.M.G., K.C.V.O., Deputy Master of Trinity House; Sir Alexander Gibb, G.B.E , C.B. ; Sir Arthur Balfour, K. B. E., President of the Association of British Chambers of Commerce ; Sir Cyril Kirkpatrik, Chief Engineer, Port of London Authority ; Sir Sydney Chapman, K.C.B., C.B.E., Permanent Secretary, Board of Trade ; Sir Albert Wyon, K.B.E., Honorary

Treasurer, British Organising Cttee; Dr. W. H. Maw, LL.D., President of the Institution of Civil Engineers ; Mr. W. B. Worthington, Ex-President of the Institution of Civil Engineers; Colonel J. G. Baldwin, C.B., Danube Commission ; Admiral Henry Campbell, C.B., C.V.O., Mr. P. R. Cadell, C.S.I., C.I.E. ; Chairman, Bombay Port Trust; Mr. Sidney Preston, C.I.E., C.B.E., Member of Congress Committee; Major General S. S. Long, C.B., Federation of British Industries; Mr. W.E. Williames, D.L., Chairman, Belfast Harbour Board, and Mrs Williames; Major Wilbraham, D L., Chairman, Weaver Navigation ; Mr. M. F. G. Wilson and Mrs Wilson ; Mr. D. Ross Johnson, C.B.E., General Manager of the Port of Bristol ; Mr. J. Foster King, C.B.E., Chief Surveyor of the British Corporation Survey and Register of Shipping ; Mr. J. R. Brooke, C.B., Secretary, Ministry of Transport ; Dr. H. H. Jeffcott, Secretary of the Institution of Civil Engineers ; M. A. Lambin, General Secretary of the Permanent International Association of Navigation Congresses and Mr. R. B. Dunwoody, O.B.E., Hon. Secretary of the Congress.

The toasts of « His Majesty the King » and of « The Sovereigns of the Kingdoms and the Presidents of the Republics represented at the Congress » were proposed by the President and accorded

« The Permanent International Association of Navigation Congresses. »

The Rt Hon. **Neville Chamberlain,** M.P., Minister of Health, said he felt greatly honoured at being entrusted with the task of proposing the chief toast of the evening, « The Permanent International Association of Navigation Congresses ».

He understood that more than a generation had passed since one of the Congresses had been held in England, and it was, therefore, all the more gratifying to find that the present Congress was attended by so many distinguished representatives of foreign nations and of International Commissions as well as some representatives from the Dominions beyond the seas.

The subject dealt with by the Congress, Navigation, Inland and Maritime, touched very nearly every civilised country. As the development of the world proceeded so the interdependence of the nations tended to increase. Every nation began to rely less and less upon its own resources and more and more upon the supplies that it obtained from other countries. That was all in the general interest because it left each country free to devote itself to fostering those industries and occupations which were most suitable to its own resources and to its proximity to raw materials, fuel or labour. The result of that process was that they were all becoming more dependent upon cheap transport for the provision of the supplies that were needed; and since water transport must always take an important place among the different forms of transport it was well that engineers and those who were responsible for carrying out works which had for their object the improvement of ports, rivers or canals should meet together from time to time to discuss their experiences, to exchange views, and to learn what were the modern applications of those principles which had been worked out in different circumstances and under different conditions in various parts of the world. It must seem rather strange to the delegates that the toast should be proposed by a Minister of Health. (*Laughter*). There did not at first sight seem to be very much connection between a Minister of Health and navigation, but he wished to inform the delegates that in this country the Ministry of Health comprised almost every other subject under the sun except health. (*Laughter*). Although transport was the subject dealt with by another Department yet the conditions under which the people lived who navigated the vessels, on at any rate inland waters, came under his aegis. He thought there was perhaps another reason which had led the Chairman to invite him to undertake the task, namely that for a long time he had taken a very great personal interest in one particular form of navigation, namely, the navigation of inland waterways. (*Cheers.*) England, which had taken such a foremost place in trans-oceanic transport, was perhaps more backward than any country represented at the banquet in inland navigation, and the reason for that state of affairs was not very far to seek. Great Britain was a small country surrounded by the sea, which served it in somewhat the same way that rivers and canals served other countries. Its water resources were limited and its rivers were not upon a Continental scale. In addition there was another reason. In most of the countries on the Continent the State had taken an active interest in the development of its inland waterways. It had assisted them financially and in other ways, and through State intervention and State aid the waterways had assumed a very

important part in the transport system of most of them. This country, however, liked private enterprise ; the State had stood on one side, and it had left the waterways to the hasards of competition and the chances of fortune. As a result, about one-third of the inland waterways were controlled by their principal competitors, which, as the delegates might imagine, had not had a very stimulating effect upon them. If it was remembered that in addition to that there was not a single through route of importance which was in the hands of one owner throughout its length he thought the delegates would have no difficulty in understanding why it was that English canals and waterways were pretty well in the same condition, in fact he thought rather worse on the whole, than they were when they were constructed about a hundred years ago. (*Laughter.*) He had always believed that even in England there was scope for the development of inland waterways. (*Hear, hear.*) He knew that foreign visitors, particularly American visitors, were rather amused when they came to this country and saw the diminutive size of its locomotive and rolling stock. Nevertheless, somehow or other those minute instruments did manage to carry the traffic of the country. It was true that they charged a great deal too much for doing so. (*Hear, hear*), but he could not help thinking that a little healthy competition with waterways would reduce their charges far more effectually than the provision of the largest locomotives in the world. While it was found that the traffic requirements of this country were met on the railways by a smaller amount of equipment than was customary on the Continent, he had never thought it was necessary to employ vessels of the size of those which plied on the Rhine or on some of the larger Continental canals. If English canals were given a fair chance ; if they possessed the three essentials, first of all, of an efficient and properly maintained waterway ; secondly, adequate provision of terminal facilities ; and, thirdly, a regular service, he felt convinced it would be found that water transport instead of being the obsolete thing that some people had hastily pronounced it to be, would turn out to be a very valuable addition to our resources and a very valuable stimulus to our trade (*Cheers*). He was afraid this country could not show its foreign visitors anything that they could learn in the matter of canals, except how not to do it. (*Laughter.*) On the other hand, he understood the foreign delegates were going to visit some of the great ports of this country, and he thought there at any rate it would be possible to show them docks, warehouses and an organisation which, for their purpose, were second to none in the world. (*Cheers.*) He hoped the delegates would find the conference as fruitful in information and in progress as previous conferences had been; he trusted that it would conduce

to that international harmony of which the world was so gravely in need at the present day. He desired to extend to the Association his best wishes for its future prosperity and success, and he asked the delegates to drink the Toast with enthusiasm, coupling it with the name of M. Gevaert. (*Loud cheers.*)

The Toast was enthusiastically honoured.

M. Gevaert (Belgium), President of the Association, speaking in French, responded to the Toast.

Ladies and Gentlemen,

The eminent speaker whom you have just heard, the Right Honourable Neville Chamberlain, Minister of Health, has expressed a wish for the prosperity of the Permanent International Association of Navigation Congresses.

We are extremely moved at this mark of interest for our Association, and on behalf of the latter, I beg His Excellency to kindly accept our heartiest thanks.

What gives a high signification to the expression of esteem which His Excellency has cited in select terms and not exempt from humour, is that it emanates from a member of the British Government, of this Government haloed with an enormous prestige in the eyes of all peoples of the world and which means the definite consecration of all works which it patronizes.

Therefore it is above everything to this Patronage that the XIIIth Congress of Navigation, held in your superb capital, owes its brilliant success.

I am then only performing a duty which is incumbent on the President of the Permanent Association, by asking His Excellency the Minister of Health to kindly express our profound and respectful gratitude to His Majesty the Emperor and King.

The honourable Mr. Neville Chamberlain, who has been so amiable towards us in his speech, has been, on the contrary a little severe for his compatriots by giving them to understand that they have not appreciated, the real value, of the inland waterways of which the competition against the railways would be salutary, and would bring about a reduction in the price of transport more efficacious than putting into service the most powerful locomotives in the world.

This observation made to a nation characterized by a spirit eminently practical is a surprise to us ; but this surprise disappears before the explanation of Your Excellency.

It is that railways and canals are in the same hands and that their owners do not think it opportune to further develop the water-

ways because they consider them likely to diminish the traffic of the railways.

For us, Belgians, this declaration is interesting because we have to oppose to it another declaration which is peculiar to us.

In our country the inland waterways, like the railway have taken simultaneously a considerable development although they are with a few exceptions in the same case as your country, that is they are in the same hands. Only these hands are those of the State, of which, let it be said in passing, everybody does not appreciate in the same way the aptitude of assuring the success of a concern having to assume, by its very nature, an industrial character.

The State owner of lines of transport by rail and water, assume a double task, by confiding their management to two distinct administrations.

One can easily imagine what such a state of things engenders.

Instead of co-ordinating the tariff so as to get the best output from the whole of these lines, the organisms working them try to monopolize the traffic, by working at a loss, rather than giving over the transport to the one of these organisms which owing to the various circumstances, such as the time that can be devoted to it, nature of goods, facilities of loading and bringing to destination, etc., is the best qualified to see to it.

In this strife the most powerful is victorious ; I will not design it otherwise than by saying that the predominating power is not found on the side of the water-ways.

You see, after that, Excellency, that in my country as in yours all is not perfect in this domain.

Inland water-ways are wanting in your country ; your opinion invested with authority, is that it is regrettable.

In our country there are very many water-ways of this kind, but we do not use them to the best advantage ; that is in my opinion also regrettable.

But I perceive, Ladies and Gentlemen, I am wandering too far away from my subject, please excuse me. It was owing to the sustained attention which I gave to the highly interesting speech of His Excellency, the Minister of Health, which by the situation which he has denounced, has caused automatically, if I may say so, the comparison which I have just made between the State of things existing in our two countries.

Allow me to add that if the inland water-ways are not numerous in Great Britain, there is one of them which has been a great factor in the construction of the Brussels Maritime Canal, which we believe has a great future before it. This canal which links up our capital to our great port of Antwerp is the imitation of your

Manchester and Liverpool canal, whose makers have given our engineers their valuable assistance and enlightened experience.

I take this opportunity to bow to one of your fellow citizens who has exerted himself with untiring complaisance to be helpful to them, Mr. Marshall Stevens.

The work of the Congress of Navigation, Ladies and Gentlemen, is all peace and work. It is the technical property of most of the nations of the world used in common, to give the greatest scope to navigation and to contribute as much as possible to the welfare of humanity.

The results already realized by our International Association are considerable ; the innumerable documents published by it since its origin are proof of it.

It will be the glory of Great Britain to have renewed the tradition of our International Assemblies, interrupted by the events of recent years.

The London Congress prepared by a group of eminent and devoted personalities, supported by the public authorities, and private organisms so powerful in Great Britain, is assured of the most brilliant success.

It will be, I am sure, the starting point of a new era of progress for our Institution.

On behalf of the Executive Committee of the entire Association, I invite you, Gentlemen, to join with me in the toast in honour of the British Government, the Minister of Health, the Right Honourable **Neville Chamberlain** and him whom I cannot more justly qualify than by calling the soul of Congress, our dear President The Right Honourable Lord **Desborough.**

« The official Delegates of Governments, the Members and other Guests. »

Sir Maurice Fitzmaurice, C.M.G., F.R.S., Deputy-President of the Congress, in proposing the Toast of « The Official Delegates of Governments, the Members and other Guests », said that Mr. Neville Chamberlain had just informed the gathering that he (Mr. Chamberlain) was proposing the main Toast of the evening. Personally, Sir Maurice considered the Toast he was proposing was much the most important. In the first place, it included Mr. Chamberlain himself, who was one of the guests of the British Committee and whom they desired to thank for attending the Banquet and making such an interesting speech. Mr. Chamberlain had informed the gathering that although he was the Min-

ister of Health he had not much time to deal with health as the other duties of his office were so extensive. Some time ago he (Sir Maurice) had to deal with a Minister of Health abroad who thought his health duties were very important indeed, and who began by assuming that all irrigation engineers reduced everything to sugar-cane and cotton regardless of human life. (*Laughter*), and great difficulty was experienced in persuading him that engineers paid great consideration to matters of health. The other reason why he thought the Toast was the most important of the evening was because it did not apply to any Association or to any body but to individuals, namely, the official delegates of Governments, the members and other guests. He had proposed the Toast of the guests at many other banquets, but on the present occasion he was quite overwhelmed when he looked round the gathering and was conscious of the large number of guests whose health he was proposing. He desired on behalf of the British Organising Committee to thank them all very sincerely indeed for attending the banquet and especially those who brought their wives with them. He did not think the value of the Congress could be over-estimated. Not only were representatives of the different countries present but also representatives of the trades of all countries, using the word « trades » in the widest sense. He desired to impress upon the gathering that it was not an Engineering Congress as some people supposed. It was a Congress composed of shipowners, shipbuilders, naval architects, managers of ports and engineers of all kinds. If it was only a conference of engineers he was not sure it would be of very great value, because engineers were a little inclined to work in watertight compartments. Unless engineers knew what shipowners wanted them to produce it was impossible to make much headway. He had been trying for the last two days to ascertain what size of ship the shipowners wanted to use in the future ; and he had come to the conclusion that he could not get an answer unless he happened to be a shipowner in the morning and an engineer in the afternoon! So far the Congress had been a very happy gathering and a lot of very useful information had been obtained. He had on many previous occasions to work with representatives from other countries. The most remarkable occasion on which he had to do this was when he was appointed as the English member of an International Commission consisting of a Canadian, an American and an Englishman. The Commission met, and it was then found that the Canadian was a Frenchman, that the American was a Pole, and that the Englishman was an Irishman. (*Laughter.*) He was glad to say that during the many years he had worked with Frenchmen, Americans, Italians an other nationalities in many foreign countries they had

invariably worked well together without the least friction of any kind. The present Congress was working without any friction at all, and he thought that might be taken as an augury and hope that friction between the various countries of the world was disappearing. (*Cheers.*) He expressed the hope that the delegates from overseas would enjoy their visit to London, and that they would not find the climate so depressing as it was frequently painted. During the following week they would visit several of the English ports and canals, and some of the latter were not as bad as Mr. Chamberlain had stated. He promised the delegates that, whatever the weather might be, good or bad, they would receive a very hearty welcome wherever they went. (*Cheers.*)

The toast was enthusiastically honoured.

Colonel J. C. Oakes (United States), who responded first, said from the little he had seen of England and of London all his expectations had been realised. England was intensely interesting. When reading Fielding, Dickens and other English authors he had built up in his mind a picture of old England, and this being his first visit to this country he had been astonished that things were so near his conception of them simply from his reading of them. He had been very disappointed in one thing however. He had looked in vain for a long time for John Bull, but he found him that day in the « Cheshire Cheese ». (*Laughter.*) John Bull was a man everyone honoured for his sterling qualities because he had made England very much what she was. He desired to express his appreciation of the very cordial reception the members of the Congress had received at the hands of the delegates, the officials and even of Royalty itself, and to assure them that they would return to their homes with the pleasantest recollections of the gathering not only from an intellectual and professional but from a social point of view. (*Cheers.*)

M. Mahieu (France), speaking in French, also responded.

Mr. President, Gentlemen,

I am very honoured and very happy to thank particularly in the name of the French Delegation, the Organizers of the XIIIth Congres of Navigation, for the cordial and somptuous reception they have prepared for us, and to express to them all our gratitude.

We are, Gentlemen, your grateful guests, and we shall take away with us the best souvenirs of our short stay in London and in England.

Where could we moreover find more excellent examples of what work and spirit of realization can do.

The capital of the British Empire, London, immense and superb, is entitled to be proud of its port and its works but we cannot forget the magnificent monuments which render its history illustrious, the admirable districts, and his circle of smiling villas and green fields.

The whole constitutes for us an idea of what the British Empire is and what a free people, confident of its destinies, and in the love of its children can accompish. Honour, Gentlemen, to London and its citizens whom we cannot admire nor thank too much.

Honour also, Gentlemen, to the Engineers, to the mariners, to the business men, to all those who, from far and near, are interested, in this country, in all what concerns Navigation, and I feel that, in thus speaking, I am addressing myself to nearly all English people. The man in the street. even if he is not born a sailor, loves the sea, the river, the canal; he knows the value of these riches and I need only give as evidence the large number of people who attend our meetings.

All the questions are studied there passionately, but also with a desire for improvement which manifests itself at each step.

Let us congratulate ourselves, Gentlemen, to have lived a few days in the middle of this atmosphere of passion for what concerns Navigation; the XIIIth Congress can but find a precious encouragement for the accomplishment of its task which is to improve the science of navigation and to lay out directives for us which will permit us, in our respective countries, to adapt water transport more suitable to their requirements.

I invite you, Gentlemen, to drink with me to our Committee, to the City of London, to the British Empire and to He who represents them, His Majesty, King George V.

Mr. H. A. F. Lindsay, C.B.E., who responded on behalf of India, said he desired to add his quota of thanks on behalf of the visitors to their hosts for their hospitality. Their labours in Congress were indeed light when they were able to carry into the drier and colder atmosphere of the Committee Room the geniality which pervaded the warmer and wetter zone of the Hotel Victoria. (*Laughter.*) A story was told of Mr. Schwab, the American millionaire and shipowner, that he was induced on a certain occasion to inspect one of his own vessels. Arrived on board he looked round in some surprise, tapped the deck of the vessel with his foot, and exclaimed: « Why, the darned thing's hollow! » He was not sure whether Colonel Oakes would corroborate the

truth of that story. (*Laughter.*) He did not quote it in any disparagement of the genius of shipowners or shipbuilders; it merely illustrated the saying that experts very often disagreed on even most elementary facts, for which discussion in Congress was the most successful panacea. The questions raised in the Congress were of great practical interest and importance to India. India had its own problems to face connected with docks and navigation. They were not altogether parochial problems, for on their successful solution depended the smoothness of their trade relations with the world's markets. He had no doubt whatever that discussion in Congress would assist India as well as the other participating countries in maintaining and extending a successful policy of development. (*Cheers.*)

Mr. T. Harada, who responded on behalf of Japan, said he found the task of responding on behalf of his country an exceedingly difficult one, in fact it was far more difficult for him to do so than to design some engineering works. (*Laughter.*) Moreover his power of expressing himself in the English language was insufficient to allow him adequately to express the thanks the Japanese delegates felt for the bounteous hospitality which had been accorded to them. He therefore contented himself with simply saying «Thank you» with a full heart, and in wishing everlasting glory and prosperity to Great Britain. (*Cheers.*)

M. Mulier, speaking in French, responded on behalf of Czecho-Slovakia.

M. Quellennec, in responding on behalf of the Suez Canal Company, said there could be no doubt it was a universal company, as its title implied, since it had opened a sea route to all seafaring nations irrespective of any nationality. All the nations benefited by it; Great Britain comes first, since this country alone represents 64.5 % of the traffic which passed through the Canal in 1922. The Suez Canal was one of the points in the world where it was possible to determine the greatness and power of the British Empire, in view of the immense amount of British shipping which passed through the Canal. For more than twenty years past the Suez Canal had been an admirable example of loyal and helpful collaboration between the two great countries of England and France. The Directors of the Company, who were composed of eminent English and French gentlemen, worked together in perfect harmony, and the Entente Cordiale was established in the dealings of the Suez Canal long before the official Entente Cordiale took place between the two countries.

Both nations endeavoured to learn from one another. They discussed any questions which might arise, not merely at official Conferences, but at friendly conversations which were the means of enabling them to appreciate one another more and more. It was in that spirit of collaboration and co-operation that the British and French worked together in the Suez Canal Company, and that was why it was exceedingly agreable to the French representatives of the Company to be honoured as guests of their British friends at the International Navigation Congress. (*Cheers.*)

« The British Organising Committee »

The toast of « The British Organising Committee » was proposed by Signor Sanjust di Tuelada (Italy) and M. Lambin, General Secretary of the Permanent Association, both of whom, speaking in French, thanked their British colleagues for the work they had done to make the Congress a success, and, in particular, Mr. Dunwoody for his arduous labours in that respect.

The toast was enthusiastically honoured.

The President, who was received with loud cheering on rising to respond, said that in view of the lateness of the hour he would be exceedingly brief in replying. As the monkey said when the grandfather's clock fell on his head, « Time presses » (*Laughter.*) He would, however, be exceedingly sorry for the banquet to finish without the opportunity being afforded to him of expressing his thanks to every one of the delegates for their kindness in accepting the invitation, and to all those gentlemen who had been good enough to say nice things about himself. About two years ago he was reported, to be dead (*laughter*), and the American Ambassador, Mr.Davis, send a very nice telegram to his wife condoling with her on her loss. When later in the day he found that he (His Lordship) was still alive he sent another telegram in which he said : « I withdraw all the nice things I said about Lord Desborough ». (*Laughter.*) He sincerely hoped that when the delegates left the banquet they would not feel inclined to withdraw all the nice things they had been good enough to say about him. It was impossible for him, in the short time at his disposal, to mention all the people who had worked to make the Congress a success. In the first place he thought, however, thanks ought to be accorded to His Majesty's Government for their hearty support; to the President and Council of the Institution of Civil Engineers for the use of their very fine building which had been of the very greatest possible assistance to the Con-

gress, and not only for the use of their building but of the staff, which had worked most loyally and generously on behalf of the Congress. Thanks should also be accorded to the President and the Council of the Association of British Chambers of Commerce for the use of their offices, of which the Congress had for the last year made a totally unwarranted use. Sir Arthur Balfour, the President of the Association was present, and he desired to congratulate him on the Knighthood which had very justly been conferred upon him for all the work he had done for British commerce. (*Cheers.*) Thanks were also due to the Lord Mayor of London who would entertain the delegates on the following day. A very long list of Associations had been kind enough to help the Congress, and he hoped when the delegates experienced their hospitality, particularly when they visited some canals of which they might or might not approve, that they would then render their thanks for the hospitality that had been accorded to them. He knew that on such an occasion he ought to conclude his speech by speaking in some foreign language, — he was not quite sure which, although he thought it naturally would be French; but he would like to conclude by speaking in all of them. He was reminded of a friend of his who went to Paris and who was asked by a friend on his return : « Did you find any difficulty with your French ? » He replied : « No, none at all, but the French did ». (*Laughter.*) He felt that if he attempted to address the delegates in all the languages which would be appropriate to the present occasion some considerable difficulties might be experienced in the deliberations of the Congress on the following day which he would be very sorry to see. (*Laughter.*) As a matter of fact, no thanks were due to him; on the other hand his thanks were due to the delegates for their presence at the banquet and for having travelled so far to take part in so important a Congress. The British Organising Committee welcomed them all with gratitude and with enthusiasm, and they sincerely hoped that the delegates would carry away with them some happy recollections of their visits. It was impossible for him to sit down without rendering a tribute to whom tribute was due. Mr. Dunwoody (*cheers*) had worked day and night in the endeavour to make the Congress the success which they all hoped it would be. The British Organising Committee felt it was a very great compliment to this country that so many distinguished engineers from all over the world should have been willing to write excellent papers and also to attend the Congress. They hoped they had done a little to make the Congress assume the importance which everyone thought it always ought to be in the maritime and inland navigation of the world. At any rate the Committee hoped they had done something at all events to bring the nations together, be-

cause without peace the progress of the world could not be secured. All the delegates were working for peace and he was sure they hoped their efforts would produce fruit in the near future. The Committee thought it was a very great opportunity for the nations from all over the world to come to London to exchange ideas in regard to the common work of civilisation, to make friends, and to go away with happy recollections of their visit. He was sure everyone would agree that the present gathering would be incomplete unless he asked the delegates to drink the health of Mr. Dunwoody who had worked night and day for the success of the Congress. (*Cheers*).

The toast was enthusiastically honoured.

Mr. R. B. Dunwoody, O.B.E. (Honorary General Secretary), who received a very warm welcome on rising to respond, said he felt it was a very great honour indeed to receive the thanks of such an influential gathering. A representative of the League of Nations had honoured the Committee by attending the Congress and that banquet, and he was sure that representative would forgive him if he said that he felt at that moment as if he had received the thanks of the League of Nations. It had been a very great pleasure to him to render any service he could, on behalf of Lord Desborough and the British Organising Committee, to make the Congress a success. No doubt other Congresses would be held in the future and if that proved to be the case he would venture to make some suggestions as to how the work of organisation might be assisted. In the first place, if the number of reports and papers increased, the work of distribution would necessitate the enrolment of a labour battalion. Personally, he had been extremely grateful for the great assistance he had always received from Monsieur Lambin, whom he thanked most heartily for the kind words he had used when proposing the toast of « The British Organising Committee ». Mr. Dunwoody considered himself fortunate in having had the honour of serving under Lord Desborough and Sir Maurice Fitzmaurice. It was a privilege for any Englishman (or Irishman as he himself was) (*Laughter.*) to work for such a distinguished nobleman as Lord Desborough, and he had always looked upon it as a very great honour that he had been able to do so. He also desired to thank Sir Maurice Fitzmaurice one of the heads of the great profession to which he had the honour to belong, for all his help and guidance. He had the pleasure of working under Sir Maurice in previous years, and he had always felt that he (Mr. Dunwoody) derived much benefit from learning Sir Maurice's methods. It was a pleasure to work for chiefs who knew what they wanted. In the next place he had

been very fortunate because he had had a very loyal and able staff. One of the members of his staff was so fond of the Congress work that he was taking his holidays during that week in order to help the Congress. (*Laughter.*) He desired in particular to refer to the assistance rendered to him by Mr. I. J. Thatcher, A.M.Inst. C.E., who had thrown himself whole-heartedly into the task for the last two years. The Congress had not been organised in a week; it had taken nearly two years to reach the results to be seen that evening, and throughout that period Mr. Thatcher had helped him in every possible way. He could not have done any more. If any other Congress wanted an Organising Secretary he strongly recommended Mr. Thatcher to them. (*Laughter and cheers.*) He had also been greatly helped in the excursion and other arrangements by Mr. Verner Macassey, A. M. Inst. C.E., and he had been most fortunate in the staff of ladies who so loyally assisted him. He also desired to thank Sir Albert Wyon for the services he had rendered as Honorary Treasurer and Mr. T. Allison, his assistant. He would always look back with the great possible pleasure upon that Congress. The work connected with it had been strenuous and hard at times, but he had received a full reward for his services by the generous way in which they had responded to the toast. (*Cheers.*)

Mrs. Max Muller said that she desired, in the name of the ladies, to thank the Organising Committee for their great kindness to them, and also most sincerely to thank Lord Desborough for the chocolates that he had presented to them. (*Cheers.*)

The Proceedings then terminated.

Luncheon by the Corporation of Trinity House.

On Wednesday, July 4th, a luncheon was given to Members of the Congress at Trinity House, Tower Hill, London, by the Trinity Brethren. Seventy-one Members of Trinity House and Guests sat down to the Luncheon, which was presided over by Sir Acton Blake, K.C.M.G., K.C.V.O., Deputy Master of Trinity House.

The Deputy Master : Genlemen, « The King ». (*Cheers.*)

The Deputy Master : Gentlemen, « The Sovereigns and the Presidents of the States represented here today. » (*Cheers.*)

Both Toasts were drunk with acclamation.

The Deputy Master : Gentlemen I am commanded by H. R. H. The Duke of Connaught, the Master of Trinity House, to express to you his great regret that owing to a previous engagement he is unable to be here to welcome you personally, but he wishes to associate himself most cordially with anything we can do for your comfort here. We have very short time at our disposal because of the arrangements which have been made for your attendance at other places this afternoon, but I hope that you will forgive me if I trespass a little upon that time just to say one or two words of welcome on behalf of my Brethren and myself to those distinguished gentlemen who are attending the International Navigation Congress in London and who have been good enough to honour us with their company here today. I am one of those who firmly believe that short speeches make good friends (*Laughter and cheers*), and not only amongst individuals but, perhaps, if I am not touching upon dangerous ground, amongst nations also. (*Cheers.*) I hope my own speech is going to be very short indeed, and I hope that our friendship will be for all time. (*Cheers.*) I think you will appreciate that although I have very little to say, that does not in any sense take away from the warmth or the sincerity of the welcome which we tender to you and with which our Royal Master is so anxious to associate himself. In this House you are living in the past as well as the present, because it is very ancient. Throughout the centuries of the existence of this Corporation it has always been their custom to try and do all they could towards helping matters connected with the sea, towards helping to promote that good feeling amongst those who are interested in the welfare of seafaring generally. Throughout the ages, further back than most of you imagine—some four or five hundred years—we have had under our roof from time to time very great men who have assisted in building up the steps by which the shipping of the world has reached the high position it is in today. (*Cheers.*) So we in turn, when we have gentlemen of so many nationalities as we have here, bound on the same errand, are glad to have you here. We hope that the Congress of which you are representatives may be happily able to arrive at many conclusions which will help still further to raise the ideal of shipping world. On behalf of the Corporation, speaking for my Brethren and myself, I bid you a very hearty welcome here and I hope that your stay, especially that of those who come from Overseas, may not only be useful but also of value and enjoyable. (*Cheers*).

Captain Hägg (Sweden). The highly and widely esteemed Corporation of Trinity House, the Guests of which we have the honour and pleasure to be today, so I am told was founded as a

private Company more than four hundred years ago, and some years later, during the reign of King Henry VIII, the Company was incorporated for the benefit of navigation and shipping. The Arms of Trinity House are a cross between four ships under sail and I read this symbol as a token of the thorough knowledge of seamanship existing in the Corporation and its strong will and power to bring all sailors everywhere within the guardianship of the British Empire and to render them every assistance. (*Cheers.*) The two ancient naval cups of pure gold on the table before me are also symbolic of the charitable intentions of the Corporation. Light-houses and light-vessels, beacons and buoys around the British coast have their organisation here and many other aids to navigation bear full witness of the never-failing attention of the Corporation, (*Cheers.*) It is with a deep feeling of admiration and pleasure that I take the liberty to propose to you, Gentlemen, to join with me in the Toast of the ancient but nevertheless young and active Corporation of Trinity House. (*Cheers.*)

M. C. Babin spoke in French.

In the name of the French delegation at the thirteenth International Congress of Navigation, I have the honour to express to Sir Acton Blake, Deputy Master, and to the honourable Corporation of Trinity House which he represents, with such distinction, our heartiest thanks for this friendly reception.

We are happy to be the guest of this brilliant corporation whose foundation goes back to upwards of 400 years, and which has brought to such a high degree of perfection the signalling and the beaconing of the British coasts; we also form the warmest wishes for the continuation of its prosperity.

I do not intend to recall anew the ancient origins of your Corporation, which existed already at the beginning of the XIVth century.

During the year 1836, an Act of Parliament decided the dispossession of the light-houses conceded to private parties and presenting a character of general interest, and submitted to your supervision the lighthouses, buoys and beacons of local interest.

This dispossession must have been very burdensome for your Corporation, for I have read, in the Mission paper of one of my predecessors at the Direction of Lighthouses of France, that one of these dispossessed lighthouses had a net income of over 20,000 pounds.

It is from that time that dates the great development of your services, which have furnished the English coasts with the most up-to-date material and the newest installations.

I raise my glass to the honour of the Corporation of Trinity House and its most distinguished Deputy Master !

The Deputy Master. — Gentlemen, I wish that I were able to speak in another language to my own as well as Captain Hägg, but I should like to thank both Captain Hägg and M. Babin not only for their eloquence, but for the very felicitous terms with which they have expressed themselves with regard to the Corporation of which I happen to be at the moment the Deputy Master We are grateful to you for the kind way in which you have received this Toast but, after all, the pleasure is ours, not yours. To us nothing is more pleasurable than to be able, according to our small means, to dispense hospitality to those who are connected with the sea, who do what they can to help those who have their work on the great waters, and we are very hopeful that what you do in another place may come back and help us in times to come. I thank you very much for the manner in which you have received the Toast, not only of the Corporation, but of myself. (*Cheers.*)

Professor Luiggi (Italy). — Gentlemen, the Deputy Master has said that short speeches make long friendships. I come from a city, Genoa, the birthplace of Colombus where people are accustomed to speak very little and to do things. We were accustomed to come to this country six or seven hundred years before the birth of Christ — we traded with Cornwall for tin for the bronze weapon we used in the Mediterranean at that time. Then we came much later after Christ and traded with England in the Mediterranean, and we do a very large trade nowadays. (*Hear, hear.*) For more than twenty-five centuries we have traded with Great Britain and we have never had the slightest disagreement and there has always been the greatest sympathy between the Italians and the English. (*Cheers.*) I hope that this will last for ever, not only between Great Britain and Italy but between all the nations that are here represented. I think I interpret the sentiment of all the delegates of all the nations present in thanking you, Sir, for the very great and kind hospitality you have bestowed upon us. We thank you very much. With these sentiments I raise my glass to propose to you that you drink the health of the Deputy Master, and drink to that great nation, Great Britain. (*Cheers.*)

The Deputy Master. — I am sure you will not expect me to reply again to such an eloquent speech as we have had from Professor Luiggi, who speaks my language better than I do myself. (*Laughter.*) But I have to tell you that I have been sitting here with my eye upon the clock. It is not that you have exhausted our hospitality, but we should be glad if you would just look round

the House, and do what you like in the House itself before you leave for further investigations.

Luncheon by the London Chamber of Commerce

On Wednesday, July 4th, a number of the delegates were entertained at Luncheon by the London Chamber of Commerce at Fishmonger's Hall, London Bridge, E.C., the President of the London Chamber of Commerce (The Rt Hon. The Lord Kylsant, G.C.M.G.) occupying the Chair.

The Toasts of « His Majesty The King » and « The Rulers of the Nations represented by the Congress » were proposed by the President and enthusiastically honoured.

« Our Guests »

The Chairman, in proposing the Toast of « Our Guests » said :

My Lords, Ladies and Gentlemen,

As President of the London Chamber of Commerce, I have great pleasure in giving a hearty welcome today to the Delegates of the International Navigation Congress.

It is a striking example of international cooperation that the Delegates represent no less than thirty-one countries which have officially associated themselves with the objects and proceedings of this Congress. It is especially appropriate that the London Chamber of Commerce should have the honour of entertaining its Guests today in the heart of the City of London, and we are grateful to the Fishmonger's Company — one of the greatest of the ancient City Guilds — for the privilege of receiving the Delegates in this — their historic Hall. This is the only one of the old City Halls which actually stands on the banks of the River Thames and within the tidal area of the Port of London.

This afternoon, many of our Guests will have the opportunity of inspecting the Port of London and of seeing some of its outstanding features, which I feel sure they will find of practical interest. For ages this City of London has been the centre of National and International trade and shipping. World commerce has flowed for centuries up and down this river to and from all quarters of the globe. Our commercial relations with the outside world, upon which the very existence of Great Britain depends, are intimately connected, as in the earliest times, with

the skilled navigation of the Thames and the facilities which the Port of London affords for shipping. Whilst, as you will see for yourselves, much has been and is being done to maintain, improve and extend the equipment of the ports of this country, we, on our part, appreciate that other nations are also moving in the same direction and are further developing their waterways and ports, as well as adopting progressive methods of handling cargo and navigating ships. It is this impulse towards mutual advancement in all matters relating to maritime commerce that has inspired the holding of this Congress.

The time for such a Congress is singularly opportune; there is an abundance of goodwill among business men and an eagerness to get the wheels of commerce into full running once more. As a ship-owner myself, with vessels trading to almost every port in the world, nothing appeals to me more than the practical adaptation of the results of scientific achievement to increasing efficiency in the process of exchanging commodities between nations.

The Congress will have performed a great service to the world at large if, as a result of its deliberations, trade and commerce, which are the lifeblood of nations, flow more smoothly, economically and efficiently. I trust that much practical good will result from this Congress; but, apart altogether from material benefits, it will, I am confident, have the effect of increasing better understanding and good feeling between nations and thus facilitate peaceful intercourse for the benefit of mankind. (*Cheers*)

On behalf of the London Chamber of Commerce, I therefore welcome you most cordially today and wish every possible success to the Congress in which you are taking part. (*Loud cheers.*)

The Toast was enthusiastically honoured.

M. E. Gevaert (Belgium), speaking in French, thanked the President and the London Chamber for their bounteous hospitality and wished the Chamber every success in its labours.

Sir Maurice Fitzmaurice, C.M.G., F.R.S., (Deputy President of the Congress), who also responded, said:

Mr. President, Ladies and Gentlemen,

It is a great pleasure to me to add my thanks to those of M. Gevaert to the President and Council of the London Chamber of Commerce for the magnificent entertainment they have given us today. The difficulty is not to find out what the London Chamber does, but to find out what it does not do. (*Laughter.*)

Its ramifications are very great, and in connection with navigation they are enormous. Therefore we are extremely pleased and gratified at the fact that they have invited us here today because these entertainments add very much indeed to the pleasure of these Congresses. I should like to correct one misapprehension, which I have mentioned on a previous occasion, namely, that some people seem to think that this is an Engineers Congress. It is nothing of the kind. It is a Congress of ship-owners, shipbuilders, naval architects, Managers of Ports and engineers of all kinds. We engineers are very much interested in ports, but we are only the servants of the ship-owners. We have to build the wharves and docks to accommodate the ships which they wish to send there; and I do not mind saying that we are in very great difficulties. We find it very difficult to get any ship-owner to tell us what sized ship he is going to send to any port within the next twenty years. I am very glad that Lord Kylsant, a great ship-owner, is presiding over this luncheon because I should like to tell him that although you can build the biggest ship in the world in two years, it takes perhaps ten years to build a port. If, after you have built a port, you find that it is not big enough for the biggest ships that go there, you receive the curses of all the ship-owners. (*Laughter.*)

I will not take up any more of your time, because you are shortly going to see the Port of London. Without wishing to be at all discourteous either to Lord Kylsant or to the other members of the London Chamber, I must inform those delegates who are going to the Port of London that they must start almost immediately. (*Cheers.*)

M. Sylvain Dreyfus, speaking in French, also responded on behalf of France, and in doing so thanked the London Chamber for their hospitality and eulogised the work it was doing.

M. Pyau Ling (China) who also responded, said :

M. President and Gentlemen,

In thanking you for your cordial welcome and kind entertainment. I can only say that, as in the « Arabian Nights », you are repeating for the one-thousand-and-first time the hospitality which has been accorded to us. I desire to express to you the feelings of gratitude which I, and I am sure all my fellow delegates, feel for your kindness to us. I fully agree with the remark made by one of our hosts, who said that those delegates who had come to London for the first time should visit it again. Indeed London is such a wonderful place that it is almost impossible for

us to absorb its treasures in a day, or a week. It is a City not only famous for its beautiful sights, but also for its hospitality. It is a magnificent centre from many points of view. For instance, navigation and commerce, which form the subject matter of our present Congress, furnish us with materials for study and investigation. In the first place, London is the centre of the world's commerce; in the second place, it is the capital of the great nation which occupies the foremost place in navigation and which has for centuries been the mistress of the seas. I thank our English friends for having invited us to hold our Conference in London. The very choice of London for the Navigation Congress meant that it would be a success. We come here and exchange our views with our English friends; we visit the ports, shipyards, harbours and canals and see everything with our own eyes. In coming to London we come right into the centre of that inexhaustible secret of commerce and navigation. In this sense the invitation of our English friends has bearings of far-reaching importance in connection with the future of the world's navigation and it tends to the promotion of world-peace and civilisation. (*Cheers.*) We therefore desire to return our heartiest thanks to the President, Council and members of the London Chamber of Commerce, who have contributed in such an eminent degree to the success of the Congress. (*Cheers.*)

« The Chairman »

Sir Arthur Balfour, K.B.E. (President of the Association of British Chambers of Commerce) :

Ladies and Gentlemen,

I desire to propose the Toast of the health of Lord Kylsant, our Chairman. (*Cheers.*) Lord Kylsant is one of the greatest transport workers the world has ever seen. He has done much for transport throughout the world because there are few ports in the world where his ships cannot be found. He has high traditions behind him which he worthily upholds and he follows a great leader. When I was in Rome recently at a great international Conference, I was convinced, for the first time, that Julius Ceasar visited Great Britain in B.-C. 55 not for the purpose of conquering Great Britain, but because he heard that our roads were in a very bad condition and that we needed better roads. (*Laughter.*)

It was Lord Klysant's happy idea that this luncheon should take place on the banks of the Thames. I doubt whether the Guests from abroad realise that this great Fishmonger's Company has some wonderful traditions. Members of the Royal

family are closely connected with it; the Prince of Wales is a Freeman of this Company. We are lunching today in a Hall which has great traditions and which I know is always placed at the service of the London Chamber of Commerce when they wish to entertain friends from abroad. I have very great pleasure in asking you to rise and drink the health of our Chairman, Lord Kylsant, and, at the same time, to wish him and the London Chamber every prosperity in the future. (*Cheers.*)

The toast was enthusiastically honoured.

The Chairman, who was received with cheers on rising to reply, said :

I thank Sir Arthur Balfour for the very kind way in which he proposed my health, and I appreciate in particular what he said about this ancient Hall. I thank you all very much, Ladies and Gentlemen, for the kind manner in which you received the Toast on my health, I hope that as a result of these meetings in London the trade of the world will improve. (*Cheers.*)

The proceedings then terminated.

Visit to the Port of London.

The first of a series of visits to various Ports was made on the afternoon of Wednesday, 4th July, when by kind invitation of the Chairman (Viscount Devonport) and members of the Port of London Authority, a visit was made to the Royal Victoria and Albert and King George V Docks. A special train was kindly provided and a party of 176 members of the Congress who had attended the luncheons given by the Corporation of Trinity House and the London Chamber of Commerce, left Fenchurch Street Station at 2.25 p.m. and arrived, after a short journey of a little over a quarter of an hour, at Custom House Station in the vicinity of the Royal Albert Dock. Here the party was welcomed by Captain Sir Arthur W. Clark, K.B.E., a member of the Authority, Mr. D. J. Owen, the General Manager, Sir Cyril Kirkpatrick, M. Inst. C.E., the Chief Engineer, and several others of the leading officials of the Authority. The programme arranged was by no means arduous, thanks to the facilities provided by the Authority.

A quick inspection was first made of a new Tobacco Warehouse in the Royal Victoria Dock and the party then went aboard the steamer which proceeded to the new cold stores on the North Side of the Royal Albert Dock. An inspection was made of the new cold store and cold sorting shed. The installation is capable of storing 646,000 carcasses of mutton at one time. The party then re-embarked and proceeded through the Royal Albert Dock into the King George V Dock viewing generally en route shipping, transit sheds, jetties, cranes, etc. The party landed on the North Side of the King George V Dock and inspected one of the double storey ferro concrete sheds. Special interest was shown in the overhead travelling cranes on the upper floor of this shed.

The party re-embarked and then proceeded out of the King George V Dock lock entrance into the River Thames and thence up the river to the Billingsgate, near the Tower of London, reaching it shortly after 5.20 p.m. Tea was served on board the steamer and the weather conditions were perfect.

The trip up the River on the steamer afforded the party an opportunity of seeing the great riverside activity of the Port of London and also of seeing the entrances to several other of the docks under the control of the Port of London Authority.

Reception by the Lord Mayor and Lady Mayoress of London at the Mansion House.

On Thursday afternoon, 5th July, 1923, the delegates were received by the Lord Mayor and the Lady Mayoress of London at the Mansion House. Many of the delegates availed themselves of the opportunity afforded of viewing the interior of the Mansion House and the many works of Art which it contains. The guests were received by the Lord Mayor and Lady Mayoress and hospitably entertained. Many expressions of appreciation of this entertainment were subsequently received.

Visit to Windsor Castle.

On Saturday, 7th July, many of the delegates visited Windsor Castle. A special train was arranged through the kindness of

the Great Western Railway Company and after luncheon in Windsor, the visitors inspected the State Apartments and St-George's Chapel. An opportunity was also given to the delegates to inspect this reach of the River Thames. Visits were also paid to Eton College and Chapel and after tea the party returned by special train to London.

Visit to Taplow Court.

On Sunday, July 8th, the Delegates and the Ladies accompanying them were the guests of Lord and Lady Desborough at their beautiful home at Taplow Court on the banks of the River Thames. The guests were received by Lord and Lady Desborough at the entrance and had opportunities of viewing the house and gardens. Visits were also paid to the Thames at Boulter's Lock, where the special mechanical conveyor erected by the Thames Conservancy Board, was exhibited to the visitors under the guidance of Mr. Griffiths, the Engineer to the Board.

Refreshments were served in the Gymnasium and a most enjoyable afternoon was spent.

A photograph showing Lord and Lady Desborough surrounded by their guests in front of Taplow Court was taken and is reproduced at the end of this volume.

Visit to the Southampton Docks.

By kind invitation of the Chairman and Directors of the Southern Railway Company a visit was paid on Monday, July 9th, by nearly 200 members of the Congress to the Southampton Docks. A special train was kindly provided by the Southern Railway Company which left Waterloo Station at 9.15 a.m., arriving at Southampton Docks just after 11 a.m. The party was welcomed by Major Szlumper, Dock and Marine Manager, and also by Mr. F. W. Wentworth-Sheilds, O.B.E., M.Inst.C.E., Dock Engineer, and other officials of the Company. The party first of all inspected the Trafalgar Dry Dock and then embarked on a Tender and proceeded to the International Cold Storage and Ice Company's premises passing en route the site for the new Floating Dry Dock. After inspecting the Cold Stores, the party inspected several car-

sheds and made a further inspection of the Docks by Tender. They also visited Messrs. Simons (Southampton) Ltd. Fruit Auction Room. The visitors then boarded the R.M.D. « Olympic » at the invitation of the Directors and Managers of the White Star Company and were entertained to luncheon in the dining saloon of the ship. Mr. Harold A. Sanderson, Chairman of the White Star Line, presided

On behalf of the White Star Line, Mr. Sanderson extended to the visitors a cordial welcome to the Olympic. He expressed the hope that their visit to the docks had been both pleasant and instructive. Southampton, he said, was essentially a port for mail and passengers steamers, having been endowed with most advantageous natural facilities. These facilities were being utilised as much as possible, and the Harbour Board and the Southern Railway Company were to be heartily thanked for the development of the Port, which had resulted in its being in the prosperous condition they found it that day.

The size of docks had always been a subject on which there had been a great amount of discussion. He remembered reading recently some newspaper cuttings relating to the advent of the first White Star liner, the old « Oceanic », in 1869. These he had compared with some regarding the « Majestic », and in both cases the vessels were said to be the last word in liner construction, and the largest that would ever be built. Southampton now supplied accommodation for two ships each of which claimed to be the largest in the world; but her distinction did not end there, for she also accommodated two vessels that claimed to be the fastest in the world. He suggested that when the visitors next wanted a subject for discussion they should consider « Ocean records in relation to ocean currents. » He by no means treated lightly the matters they had recently discussed, for he believed there was no question more important than that of navigation. Those who were engaged in running ships to all parts of the world must recognise that those vessels were a great factor in the maintenance of peace. They came backwards and forwards like a shuttle weaving a fabric, and the result was than they created the harmony of which the world was so much in need.

The Mayor of Southampton then followed with warm words of welcome on behalf of the Municipality.

Major G. S. Szlumper, the Docks and Marine Manager for the Southern Railway, tendered greetings on behalf of the Chairman and chief officers of the Southern Railway Company, who, he

said, were detained in London on important Parliamentary business. Commenting on the references to large ships, he said that from the Docks Manager's point of view the actual size of a ship did not much matter. Whether one talked in hundreds or thousands was only a matter of degree, and he hastened to point out that the authorities in Southampton were out to meet that degree. It was not the biggest ship that counted, but the best ship. The Southern Railway would leave no stone unturned in their efforts to make Southampton pre-eminent in its facilities. They had great schemes for development, which were at present in the hands of the engineers—there were no better engineers in any other part of the country—and it was anticipated a commencement would be made next year to carry them into effect.

Sir Maurice Fitzmaurice, C.M.G., F.R.S., Deputy President of the Congress, replied on behalf of the Congress and said he had been asked by Lord Desborough, President of the Congress, to express regret at his non-attendance, and to thank the White Star Line and the Southern Railway Company for the hospitality that had been extended to the members that day. He, personnally, had been interested in the remarks concerning big ships, as during the course of the Congress last week one of the discussions had been on the subject. « What is the largest ship that may be expected at any port in the next 20 years ? » They had been dreaming about the future and had come to the conclusion that both shipowners and engineers have had a nightmare, as they have been unable to answer the question. Sir Maurice pointed out that a ship like the « Olympic » could be built in two years, but it took probably ten years to build a dock. There may be four or five kinds of vessels in that time, so that when the docks or harbour are completed, there is a chance that they will be obsolete. On the other hand the life of a ship is roughly 20 years, and the life of a harbour probably 100 years. The question is whether many ships of 40 ft. draught are going to be built in future. That, however, Sir Maurice concluded would not worry them much in Southampton as it was the only port in England that could accommodate them.

M. Gevaert, President of the Permanent Association, also spoke.

The party left the Docks shortly after 4 p. m. and returned to London. The delegates one and all expressed their warm thanks for a most enjoyable day.

The British Organising Committee made arrangements to en-

able the delegates to visit important Docks on the 10th and 11th July, viz., to South Wales Ports, Bristol, Manchester and Liverpool, which necessitated the division of the Members of the Congress into two distinct parties—one party going to South Wales and the other to Manchester and Liverpool.

Visit to South Wales Docks.

Owing to a thunderstorm of unprecedented violence during the night, the party going on Tuesday, July 10th, to South Wales fell short of about 150 who had expressed a desire to join in this visit.

The principal docks of South Wales are owned by the Great Western Railway Company, who also have docks in various parts of England and have the great distinction of being able to call themselves the largest dock-owning company in the world.

The excellent arrangements and liberal hospitality of the Great Western Railway Company gave the party an opportunity of inpecting several of the South Wales Docks in one day with very little personal fatigue.

By kind invitation of the Chairman and Directors of the Great Western Railway Company a party of about 120 delegates and members left London by special train at 8.40 a. m. on Tuesday, 10th, and arrived at Newport at 11.15 a. m. when they were met by Mr. J. H. Vickery, Chief Docks Manager of the Great Western Railway and other prominent officials of the Company. The visitors were joined at Newport by a representative gathering of South Wales business men and proceeded by special train to Newport Docks.

The party alighted at the large Government factory erected during the war and afterwards proceeded to the south lock entrance of the Alexandra Dock. This sea lock entrance, 1,000 ft. x 100 ft. with 48 ft. depth of water on the sill at high spring tides, is the largest in the world. A visit was then made to the Pumping and Power Station and then to the large coal hoists, one of which is capable of raising a 20 ton capacity truck and tipping it at a height of 75 feet above water level.

At 1.0 p. m. the party embarked on the s. s. « Glen Avon » for Cardiff, and were entertained en route to luncheon by the Great Western Railway Company. Mr. J. H. Vickery, in the course of

a brief speech, said he could not let the occasion pass without welcoming to the South Wales ports the members of the International Navigation Congress, and he was delighted to have the opportunity of reciprocating the well-known hospitality to delegates which was always displayed by the various countries where the Congress had assembled. He regretted that the directors and general manager of the company were absent as the visit of the delegates to South Wales synchronized with the annual inspection of the Channel ports. They hoped, however, to meet the members of the Congres next day at Bristol.

Mr. Sidney Preston, C.I.E., C.B.E. Member of the British Organising Committee returned thanks, in the absence of the Right Hon. Lord Desborough, K.C.V.O., the President and of Sir Maurice Fitzmaurice, the Deputy President. In the course of his remarks Mr. Preston referred to the enormous development of the Great Western Railway, and associated all the visitors with him in wishing the Great Western Railway under the grouping system every possible success.

Monsieur A. Van Hecke, Engineer, Professor at the University of Louvain, a Belgian official delegate, gave a brief speech in French, and added his thanks to those of Mr. Preston for the hospitality shown to them.

Arriving at the entrance to Queen Alexandra Dock the party inspected the cold stores, capacity 100,000 carcasses, on the north side of the dock and the « G » general cargo warehouse, and afterwards viewed the « A » warehouse, which was purchased from the Ministry of Shipping, for whom it was erected during the war. After inspection of the Lewis-Hunter patent anti-breakage coaling cranes and the power station they embarked on the steamer for Barry Dock. Tea was served en route, and upon arrival at Barry Dock, the Lady Windsor Deep Water Dock was inspected, and the Commercial Graving Dock and the various coal tips and also the general cargo equipment at No. 2 Dock.

After viewing the general cargo, transmit and grain sheds, the party made their return journey by special train which left Barry Docks at 5.30 p. m. arriving in London at 9.25 p. m. after a most enjoyable day.

Visit to the Port of Bristol.

On Wednesday, July 11th, the day following the visit to South Wales, a visit was made to the port of Bristol by kind invitation of the Chairman and Members of the Bristol Docks Committee.

The hospitality of the Great Western Railway Company on the previous day was extended still further to the Congress in so much as they very kindly conveyed the whole party from London to Bristol and back.

The party of just under 100 delegates and members left London at 9 a. m. and arrived at Bristol about noon and proceeded by char-à-banc to the Avonmouth Docks when they were received by the Lord Mayor and Lady Mayoress of Bristol. Luncheon was then served at the Royal Edward Dock passenger station. The Lord Mayor of Bristol presided at the luncheon and was supported by the Lady Mayoress, Alderman H. W. Twiggs, Chairman of the Docks Committee, and several members; the Right Hon. Viscount Churchill, Chairman of the Great Western Railway Company, and many directors and officials including Mr. Felix J. Pole, General Manager, and a number of prominent citizens of Bristol, members of the Corporation and dock officials.

The Lord Mayor in extending a civic welcome to the delegates and visitors, said the City of Bristol had over £ 7,000,000 invested in the docks. Referring to two classes of traffic — that of tobacco and bananas — he said that more than a third of each of these commodities imported into the country came to Bristol. To the Imperial Exchequer Bristol contributed £ 30,000,000, per annum, an amount only exceeded by two ports, London and Liverpool. He regarded the presence of so many distinguished gentlemen as a good augury for the future both of the port and of commerce generally.

Alderman Twiggs, Chairman of the Docks Committee, proposing « The health of our guests » said in visiting Bristol they had come to a very famous, ancient and historical city and dock. He reminded them that it was from Bristol that John and Sebastian Cabot set sail and discovered the North American mainland and that the first vessel to cross the Atlantic under her own steam was the « Great Western », a Bristol-built ship. He also

referred to the fact that the railway which had conveyed them that day had its inception in Bristol.

Viscount Churchill, Chairman of the Great Western Railway Company, in responding referred to the good progress of the port and also to the Great Western Railway Company's early connection with it and he said he wished the Port further prosperity. Since the Railway Act, 1921, the Great Western Company at become a very large dock owning corporation but he would assure them they would never forget their old friend Bristol and they hoped to hold a true balance of equality, equity and propriety, and do everything they possibly could for the Port of Bristol, notwithstanding they had other ports under their control. Bristol was the original bright star in the Great Western crown. Concluding, he welcomed on behalf of the Railway company, the distinguished representatives of foreign countries, and said that the exchange of ideas taking place at such a Congress was everything to the good. The more closely they got into touch with the business community the less likelihood was there of the world suffering from the ravages of terrible wars, like that so recently experienced.

Mr. Sidney Preston, C.I.E., C.B.E., Member of the British Organising Committee, also responded and regretted the absence of Lord Desborough, the President of the Congress. On behalf of the delegates he thanked the Corporation of Bristol and the Docks Committee for their hospitality. They could see, he said, that the port was not standing still. He also voiced the appreciation of the delegates and members of the Congress for the courtesy and hospitality of the Great Western Railway Company.

M. André de Rouville (France) speaking in French, thanked Viscount Churchill for the railway facilities provided for the delegates during their tour. He also thanked the Lord Mayor and the Chairman of the Dock Committee for the magnificent reception and hospitality on that memorable occasion. He also complimented Bristol upon the organisation and equipment of the port and wished prosperity to the Port of Bristol and the Great Western Railway.

Then followed a well organised inspection of the Docks. The

party were taken by a char-à-banc from one place of interest to another, each char-à-banc having a well informed guide.

The itinerary consisted of a bird's-eye view of the Royal Edward Dock from the flat roof of a double storey ferro-concrete shed, an inspection of the pneumatic grain discharging plant on the quay and a granary capable of storing 150,000 quarters of grain which is placed some distance back from the quay and connected by grain tunnels, an inspection of the cold storage plant which has a capacity of 600,000 cubic feet; then followed a quick inspection of an experimental ferro-concrete wharf, which it is hoped will prove equally as effective as a solid quay wall, the oil discharging berths, the large dry dock, 875 feet long, the pump house, the entrance lock, which is of the same length as the dry dock, and finally, an inspection of same very ingenious banana handling plant.

The party returned from Avonmouth to Bristol by a char-à-banc and returned by the Great Western Railway to London after a most enjoyable day.

Visit to Manchester.

On Tuesday, July 10th, 1923, a large party of delegates and members left London at 8.25 a. m. to visit the Manchester Dock and Ship Canal by kind invitation of the Chairman and members of the Board of the Manchester Ship Canal Company. After a most comfortable journey due to the excellent arrangements made on their behalf by the London Midland & Scottish Railway Company, the party arrived at Manchester at 12.55 p.m. The visitors proceeded to the Docks when they were welcomed by Mr. W. C. Bacon, Chairman, Mr. E. Latimer, Managing-Director, Mr. F. A. Eyre, Secretary, Mr. H. M. Gibson, Chief Superintendent, and other Directors and Officials of the Manchester Ship Canal Company. Embarking on one of the Company's tugs, they crossed the Dock Basin, and after inspecting some of the Docks, sailed a long part of the famous Manchester Ship Canal, which is over 35 miles long, (stretching from Manchester to the River Mersey) and allows vessels of a dead-weight capacity of as much as 15,000 tons to carry cargoes to and from the midst of the inland City.

At the large N° 9 Dock, which is half a mile in length, and ranks with the finest in this country, the party disembarked. A feature of this Dock is the fine series of 4 floor ferro-concrete transit sheds, stretching the length of the quay, into which goods are received at any point direct from the vessel, and which is served by a number of electric cranes of comparatively small lifting capacity (up to 30 cwts), but of particularly rapid movement. Some of the sheds were traversed and inspection was made, so far as time allowed, of one of the Company's large Grain Elevators (having a capacity of 40,000 tons grain) and of the up-to-date handling apparatus, which by means of endless belts running in subways beneath the quay conveys grain in bulk discharged from six ships, some berthed as much as half a mile away at the other end of the dock. The visitors were also able to get a glimpse of the Dock Railway System of the Manchester Docks, which links every berth, shed and warehouse with all the main lines railways in the country.

Returning from the Docks, the delegates proceeded to the Town Hall, where they were received and entertained at tea by the Lord Mayor of Manchester.

Later in the evening, they were the guests of the Chairman and Directors of the Manchester Ship Canal Company at a dinner given in their honour at the Midland Hôtel. At the conclusion of the dinner, Mr. W. C. Bacon, Chairman of the Company, in proposing the toast of the guests extended a hearty welcome to the visitors, expressing the hope that the coming together in Congress of men of so many different countries would promote international understanding and good will.

In regard to the Port of Manchester of which the visitors had seen something that afternoon, he outlined its development from an inland city to an ocean port of such importance that only two or three in the United Kingdom handled traffic of greater value.

M. Gevaert (Belgium), President of the Permanent Association of Navigation Congresses, in replying to the toast, expressed the gratitude of the delegates to the Ship Canal Company for the hospitality extended to them and for the facilities afforded them for seeing as much as was possible in the limited time of a waterway which ranked with the most remarkable in the world, and he

commented upon the great interest felt by the delegates in all that they had seen.

M. Watier (France) associated himself with M. Gevaert's expressions of gratitude to their hosts and remarked on the enterprise and engineering skill which had made so great a port possible.

M. Tsuchiya (Japan) and M. Wortman (Holland) also spoke in reply to the toast. The party remained the night in Manchester after a most enjoyable day and on the following morning proceeded to Liverpool.

Visit to Liverpool.

About 50 delegates and members of the Congress arrived at the Dock Office, Liverpool, from Manchester, shortly before eleven o'clock and were received by Mr. Thomas Rome, Chairman of the Mersey Docks and Harbour Board, Mr. Richard D. Holt, Chairman of the Works Committee, and Mr. L. A. P. Warner C.B.E., General Manager and Secretary, and, after visiting the Board Room and Committee Rooms, proceeded to the Dingle Station on the Overhead Railway at the south end of the Docks, from which station the party travelled by special train to Seaforth Sands Station, at the north end of the Docks, viewing the many descriptions of shipping and obtaining a comprehensive view of the docks en route, the items of interest particularly noted being:

The Stanley Dock Tobacco Warehouse which is the largest warehouse in the world, with its thirteen floors (containing no less than 35 acres) and accommodation for 70,000 hogsheads. This warehouse is 725 feet long, 165 feet broad and about 125 feet high from the street level, has a basement, quay floor and twelve upper floors. It is served with quick running lifts, is of first class fire-proof character and is unique among tobacco warehouses of the world. It is interesting to note that this warehouse can accommodate sufficient tobacco to supply the whole of the requirements of the British Isles for a period of two years.

The Sandon Huskisson and Canada systems of docks containing many of the largest vessels afloat.

The Canada Graving Dock (925 feet long) the second largest in the Port.

The Union Cold Store at the Alexandra Branch Dock N° 3 which is admittedly the largest and most modern in Europe, and which, if allotted solely to the storage of lamb, would accommodate a million and a half carcases. This store is situated on the edge of the quay and electric conveyors enable produce to be stored in its chambers from the holds of importing vessels within five minutes. The Port of Liverpool is famous for its refrigerated meat importation and distribution throughout the whole of the United Kingdom, meat discharged at Liverpool one evening, for example, being on the London Market the following morning. The total cold storage accommodation in the Port amounts to 8,282,900 cubic feet.

The party, after detraining at Seaforth Sands Station, spent an hour inspecting the Gladstone Graving Dock, the largest in Europe, and the construction of the new Gladstone System of Docks.

On the return to the city, a number of the party were entertained to luncheon at the Dock Board Pierhead offices, while another party were entertained on board the steamer « Galatea » moored at the Prince's landing-stage.

Mr. Thomas Rome, Chairman of the Board, who presided at the luncheon in the Dock Board Offices, in proposing the toast of the visitors, said Liverpool now did the greatest foreign trade of any port in the country. Notwithstanding that a number of the largest Atlantic liners had moved to Southampton, Liverpool still did far and away the largest foreign passengers trade. Their predecessors were full of pluck, perseverance and foresight in their efforts to meet the trade. He hoped the visitors would think, after seeing the North-end works, that the present Dock Board had inherited the pluck and perseverance of their predecessors. The tonnage entering and leaving the Port of Liverpool last year totalled thirty-six millions.

M. Gevaert (President of the Permanent International Association of Navigation Congresses) who responded, said the things they had seen at Liverpool had made a great impression upon them.

Liverpool was evidently taking a long view and he was sure they would be rewarded by an increase of tonnage and business.

Mr. Wortman (Holland), who also responded, said the party had been struck by the enormous harbour accommodation offered by Liverpool and the huge works laid out at the North end of the Dock Estate.

At the luncheon on the steamer « Galatea », Mr. Richard D. Holt, who presided, in proposing the health of the visitors, said Liverpool had rather special problems to deal with, one of which was the large rise and fall of the tide. That one problem alone had caused them to undertake works of a character rather different from those undertaken elsewhere. This was a port which had really been made entirely by man; they had not many natural advantages. They were trying to progress and follow in the footsteps of those who had gone before them — year by year stepping forward to something better than they knew before. The prosperity of the port was wrapped up in the prosperity of the country as a whole, and if they did not progress it would be because progression was not required.

M. Lambin (Belgium), General Secretary of the Permanent Association, acknowledged the toast and said they had been very much impressed by what they had seen in Liverpool.

Subsequently the whole party spent the afternoon cruising on the River Mersey and the Liverpool Bay viewing the docks from the River and particularly noticing ;

The Woodside and Wallasey Landing Stages which at all states of the tide serve the Mersey Cattle Wharf, the largest animals' landing place in the world at which are landed cattle, sheep, pigs and goats from Ireland and Overseas and at which is held the most important live stock and fresh meat market in the United Kingdom.

The Floating Crane « Mammoth » which is self-propelled and has a lifting capacity of 200 tons.

The Dingle Oil Jetty and Installations which are used exclusively to discharge or load, by means of pipes, oil (both fuel and cargo) from or into vessels or barges without them having to enter dock. Connected to this jetty by pipes, oil storage tanks are being provided by the leading oil companies of the world, the capacity of which, when completed, will be over 100,000 tons.

Land distribution takes place from the installations by both road and rail.

The Liverpool Landing Stage, some 2,500 feet long by 80 feet wide which rises and falls with the tide so as to enable passengers to and from liners, steam tenders or cross-river ferry-boats, to pass to or from their vessels at any state of the tide. This landing stage is situate adjacent to the heart of the City and is connected with the shore by ten bridges and by a floating roadway of 550 feet in length and 33 feet in width, on which motor and cart traffic is afforded an easy incline at all times of the tide, while alongside the Stage is the Riverside Railway Station, where passengers entrain to or from all parts of the United Kingdom.

An exceptionnally good view was also obtained by the visitors from the river of the dam and new entrance works at the Gladstone dock extension, thus affording the party a still better idea of the magnitude this work will assume when finished.

The members returned to London in the evening. All were greatly impressed with what they had seen in Lancashire.

* * *

In addition to the visits set down in the Official Programme of the Congress, the following minor visits were undertaken. These visits were arranged on the moment and were announced in the Daily Journal of the Congress.

Visit to the Zoological Gardens.

Through the kindness of Mr. E. T. Agius, a British Member of the Congress and a Fellow of the Zoological Society a free invitation was extended to the members of the Congress to visit the London Zoological Gardens and many members availed themselves of the invitation and were entertained to tea at the Zoological Society's Private Tea Pavilion as the guests of Mr. Agius.

Visit to the Houses of Parliament.

On the morning of the Windsor Castle visit, which did not start until after mid-day, Mr. Marshall Stevens, a former Member of

Parliament and General Secretary of the 3rd Congress, kindly undertook to guide a party of members of the Congress over the Houses of Parliament. The party of over 100 members assembled at the Institution of Civil Engineers at 10.45 a.m. and walked the short distance to the Houses of Parliament. They were shown over both the House of Lords and the House of Commons and also inspected the historic Westminster Hall, the famous roof of which has recently been restored.

Visit to Blakwall and Rotherhithe Tunnels.

On the morning of Sunday, 8th July, at the special request of some of the members of the Congress, Mr. G. W. Humphreys, C.B.E., Chief Engineer to the London County Council, kindly arranged a party to visit the Blackwall and Rotherhithe Tunnels. The party of about 20 members met at Blackwall Tunnel, Northern Entrance, at 9 a.m. and were taken round both tunnels by Mr. Humphreys.

The party during the visit made several enquiries of Mr. Humphreys concerning the Woolwich Free Ferry, whereupon by mutual consent he very kindly extended the visit down the river to the Ferry (which is for vehicular and pedestrian traffic), the party being taken there by motor.

Institution of Civil Engineers Conversazione.

The President and Council of the Institution of Civil Engineers very kindly extended an invitation to the Members of the Congress to their Annual Conversazione on the evening of July 12th and, although the Congress had actually finished the day previous, several members were able to accept the invitation.

* * *

Ladies special Visits.

Throughout the first week of the Congress, facilities were made for ladies accompanying delegates and members to visit places of interest in London.

Parties were arranged to visit the National Gallery, Westminster Abbey, St. Paul's Cathedral, the Victoria and Albert Museum and the British Museum. At each place a special guide was charged to take the party round.

The number of ladies attending each day varied from 15 to 30, and amongst those who joined in the visits were :

M^me^ de la Bellacasa, M^me^ Bouckaert, M^me^ van Braam van Vloten, M^rs^ Butterfield, M^me^ Van den Broek, M^rs^ Chambers, Miss Frech, M^rs^ Halcrow, M^me^ Hulswit Harpham, M^me^ Luria, M^me^ Marchiex, M^lle^ Mangaine, M^me^ Max Mühlen, M^me^ Munch-Petersen, M^me^ Nelemans, M^me^ Notte, M^rs^ Oakes, M^me^ Perrier, M^lle^ M. Perrier, M^lle^ S. Perrier, M^me^ Reigersman, M^rs^ Roberts, M^me^ Smit-Rochussen, M^me^ de Tollenaere.

Topical Press Agency Photo.

THE LADY DESBOROUGH, M. GEVAERT, THE LORD DESBOROUGH, K.C.V.O.
GARDEN PARTY AT TAPLOW COURT.
SUNDAY, JULY 8TH, 1923.

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